FISHERY RESEARCH

IDAHO SUPPLEMENTATION STUDIES

Annual Progress Report
January 1, 1997—December 31, 2001

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IDFG Report Number 03-37
July 2003

Idaho Supplementation Studies

Project Progress Report

1997-2001 Annual Report

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Prepared for:

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Project Numbers 89-098
Contract Numbers DE-BI79-89BP01466

IDFG Report Number 03-37
July 2003

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ABSTRACT

The multiagency suite of cooperative research projects known as the Idaho Supplementation Studies (ISS) was initiated in 1992 to evaluate the benefits and risks of using hatchery supplementation to increase natural production of spring/summer Chinook salmon *Oncorhynchus tshawytscha*. This report documents research tasks completed by the Idaho Department of Fish and Game (IDFG) in calendar years 1997-2001. We report numbers of hatchery-reared juveniles released in the natural rearing areas of supplemented streams. Releases were at levels prescribed in the original study design, and with the exception of a few treated streams, various life stages were released to evaluate different supplementation strategies. Measures of production in both supplemented (treatment) and unsupplemented (control) streams include adult escapement, such as Chinook salmon redd counts, carcass recoveries, and numbers of adults returning to hatchery weirs from 1997-2001. For purposes of documenting brood year production for juvenile Chinook salmon, we report emigration estimates beginning with brood year 1995 through 1999 using juvenile trapping data collected in years 1996-2001. Redd count data, which represents our most complete data set for evaluating natural production, were collected from streams managed by the IDFG in all but two years (1998 and 1999 in Big Flat Creek). With the exception of aerial counts, data were concurrently collected from Chinook salmon carcasses in those same years. Adult returns to hatchery weirs were monitored in Crooked River, Pahsimeroi River, Red River, South Fork Salmon River, and the upper Salmon River. Weirs were also used to collect wild/natural and hatchery origin adults for constructing ISS broodstock and to manage adult escapement into ISS study streams using release criteria identified in the study design. A combination of rotary screw and scoop traps were operated to evaluate juvenile production in American River, Colt Killed Creek, Crooked Fork Creek, Crooked River, Lemhi River, Marsh Creek, Pahsimeroi River, South Fork Salmon River, and the upper Salmon River. These data provided juvenile emigration estimates and life history information of naturally produced Chinook salmon. Traps also provided means for passive integrated transponder (PIT) tagging a subsample of juveniles for interrogation purposes at the lower Snake River dams. The PIT tag detection and passage data are important parameters for evaluating survival between treated and control streams.

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INTRODUCTION

The Idaho Supplementation Studies (ISS) project is a collaborative study between Idaho Department of Fish and Game (IDFG), the Nez Perce Tribe, the Shoshone Bannock Tribe, and the U.S. Fish and Wildlife Service. It was developed to determine the benefits and risks associated with hatchery supplementation of Chinook salmon *Oncorhynchus tshawytscha* in the Snake River basin. Because the scope of study is broad, streams included were distributed among the cooperating agencies, which operate under an umbrella agreement to maintain consistency for all research activities.

The ISS study design was implemented in 1992 (Bowles and Leitzinger 1991) with the following goals in mind: 1) evaluate the efficacy of using hatchery fish to restore or augment production in natural populations of spring and summer Chinook salmon in the Salmon and Clearwater River subbasins of Idaho, 2) evaluate the long-term impacts of supplementation with hatchery origin Chinook salmon on the survival and fitness of natural populations, and 3) evaluate hatchery releases at different life stages with respect to these same measures of production and productivity. To achieve these goals, a long-term experiment was designed to compare production and productivity measures between a group of experimentally supplemented (treatment) streams and a group of untreated (control) streams where natural production has experienced little or no hatchery influence. The following objectives were established to accomplish the goals of the ISS study:

1. Monitor and evaluate the effects of supplementation on the abundance of naturally produced juveniles and resultant adult returns,

2. Monitor and evaluate changes in natural productivity and genetic composition of target and adjacent populations following supplementation,

3. Determine which supplementation strategies (e.g., smolt versus parr release) provide the highest response in natural production without adverse affects on productivity, and

4. Develop supplementation recommendations.

The objectives and tasks of the ISS study are split into two main categories: supplementation-augmentation of existing Chinook salmon populations and supplementation-restoration of extirpated populations. Augmentation is limited primarily to the Salmon River subbasin, where streams are supplemented with locally developed broodstocks composed of natural fish. Restoration efforts occur predominately in the Clearwater River drainage to evaluate the success of rebuilding populations by outplanting various life stages of juvenile Chinook salmon.

Research tasks are distributed among three project phases. During Phase I, broodstock for the first generation (F_1) of supplementation treatments was developed from crosses of locally derived hatchery and wild/natural origin Chinook salmon. These F_1 fish were incubated in the hatchery and reared to parr, presmolt, or smolt life stages. They were uniquely marked prior to release in natural rearing areas to make them distinguishable from other hatchery origin and naturally produced Chinook salmon. During Phase II of the study, adult returns from F_1 supplementation releases were crossed with adult returns from naturally produced juveniles. Natural origin adults comprise a minimum of 50% of the fish used in the crosses to produce the second generation (F_2) of supplementation fish. All remaining natural origin and supplementation recruits are allowed to spawn naturally, as long as supplementation adults do not numerically exceed the number of natural fish. In Phase III, supplementation with juvenile outplants ceases, but adult returns from supplementation juveniles are allowed to enter natural spawning areas and spawn with each other or fish of natural origin to naturally supplement the F_3 generation. Monitoring and evaluation of juvenile production and resulting adult returns are conducted on the F_1, F_2, and F_3 generations to provide a means to evaluate the effects of supplementation on natural production and productivity.

In this report we document ISS research tasks completed in streams managed by the IDFG. As the lead coordinating agency we are responsible for approximately half of the total ISS study streams. Data on ISS related hatchery Chinook salmon releases, naturally produced juvenile Chinook salmon, adult escapement, and passive integrated transponder (PIT) tag detections of migrating juveniles at lower Snake River dams are provided for the period from January 1, 1997 through December 31, 2001. Evaluation of ISS data to test the effect of supplementation on production or productivity response will be completed at interim checkpoints during the final evaluation phase (Phase III) and are not part of this report.

STUDY AREA

We monitor and evaluate six tributaries in the Salmon River subbasin and eight in the Clearwater River subbasin (Figure 1, Table 1). Most study streams are predominantly low to moderate gradient headwater streams with generally high water quality. Habitat quality is considered adequate for supporting Chinook salmon, although sedimentation, channelization, irrigation withdrawal, and riparian degradation likely affect productivity of some streams (IDFG et al. 1990; IDFG 1992). For detailed descriptions of the habitat characteristics for ISS study reaches, see Bowles and Leitzinger (1991).

Fish communities are similar throughout the IDFG managed study streams. Anadromous fish include wild, naturally produced (influenced historically by hatchery outplants), and hatchery-produced spring or summer Chinook salmon and summer steelhead *O. mykiss*. Resident fish include bull trout *Salvelinus confluentus*, cutthroat trout *O. clarki*, rainbow trout *O. mykiss*, brook trout *S. fontinalis*, mountain whitefish *Prosopium williamsoni*, northern pikeminnow *Ptychocheilus oregonensis*, redside shiner *Richardsonius balteatus*, sculpin *Cottus spp.*, dace *Rhinichthys spp.*, and suckers *Catostomus spp*. Pacific lamprey *Lampetra tridentata* occur in disjointed areas of the Salmon River and Clearwater River drainages.

Salmon River Subbasin Tributaries

In the Salmon River subbasin, the Pahsimeroi River, the South Fork Salmon River, and the upper Salmon River represent treatment streams for the ISS (Table 1). Each of these is used to evaluate supplementation/augmentation of existing Chinook salmon populations. Hatchery facilities constructed for Chinook salmon mitigation (Lower Snake River Compensation Plan and Idaho Power) define the lower extent of the ISS study reaches on each of these tributaries, and both hatchery origin and wild/natural adult Chinook salmon return to each hatchery for spawning.

Marsh Creek, Lemhi River, and the North Fork Salmon River are three control streams that the IDFG monitors in the Salmon River subbasin. Marsh Creek is a tributary of the Middle

Fork Salmon River located west of Stanley, Idaho. Chinook salmon are considered native natural, with little or no hatchery influence. The North Fork Salmon River and the Lemhi River enter the Salmon River downstream of Salmon, Idaho. The Lemhi River was originally designated as a treatment stream, but due to low adult returns during Phase I and II and the inability to construct broodstock for that population, it has been reclassified as a control stream (Lutch et al. 2003).

Clearwater River Subbasin Tributaries

We monitor eight study streams in the Clearwater River subbasin to evaluate supplementation/restoration strategies (Table 1). Although natural production occurs in many of these ISS tributaries, wild Chinook salmon runs were virtually eliminated following construction of the Lewiston Dam in 1927 (IDFG et al. 1990). Spring Chinook salmon were reintroduced following improvements to fish passage and eventual removal of the dam in 1973 and were derived mainly from Rapid River stocks (Kiefer and Forster 1991; IDFG et al. 1990).

Treatment streams monitored by the IDFG in the upper Clearwater subbasin include Colt Killed Creek (formerly White Sands Creek) and Big Flat Creek. Big Flat Creek is a headwater tributary of Colt Killed Creek originating in the Selway-Bitterroot wilderness area of northeastern Idaho. Colt Killed Creek merges with Crooked Fork Creek to form the Lochsa River near the Powell Satellite Fish Hatchery. Proceeding lower in the basin, Crooked River and Red River are treatment streams located within the South Fork Clearwater River drainage. Satellite hatchery facilities managed by the Clearwater Hatchery are located on both streams near the lower end of the ISS study reaches.

American River, Brushy Fork Creek, Crooked Fork Creek, and White Cap Creek represent ISS control streams in the Clearwater River subbasin. White Cap Creek was added to the experimental design in 1992. American River was originally designated for treatment, but after receiving a single supplementation release in 1993, was reclassified as a control stream in 1996. Similarly, Crooked Fork Creek was changed from treatment to control following one supplementation presmolt release in fall of 1992 (Walters et al. 1999).

Table 1. Idaho Supplementation Study streams and the Idaho Department of Fish and Game (IDFG) cooperating regions, 1997-2001.

Agency	Subbasin	Study Stream	Treatment/ control (T/C)
IDFG Nampa Research	Salmon	Marsh Creek	Control
		Pahsimeroi River	Treatment
		Upper Salmon River	Treatment
	Clearwater	Big Flat Creek	Treatment
		Colt Killed Creek	Treatment
		Crooked Fork Creek	Control[a]
		Brushy Fork Creek	Control
IDFG Lewiston Region	Clearwater	American River	Control[a]
		Crooked River	Treatment
		Red River	Treatment
		White Cap Creek	Control
IDFG McCall Region	Salmon	South Fork Salmon River	Treatment
IDFG Salmon Region	Salmon	Lemhi River	Control[a]
		North Fork Salmon River	Control

[a] Reclassified from a treatment to a control study stream.

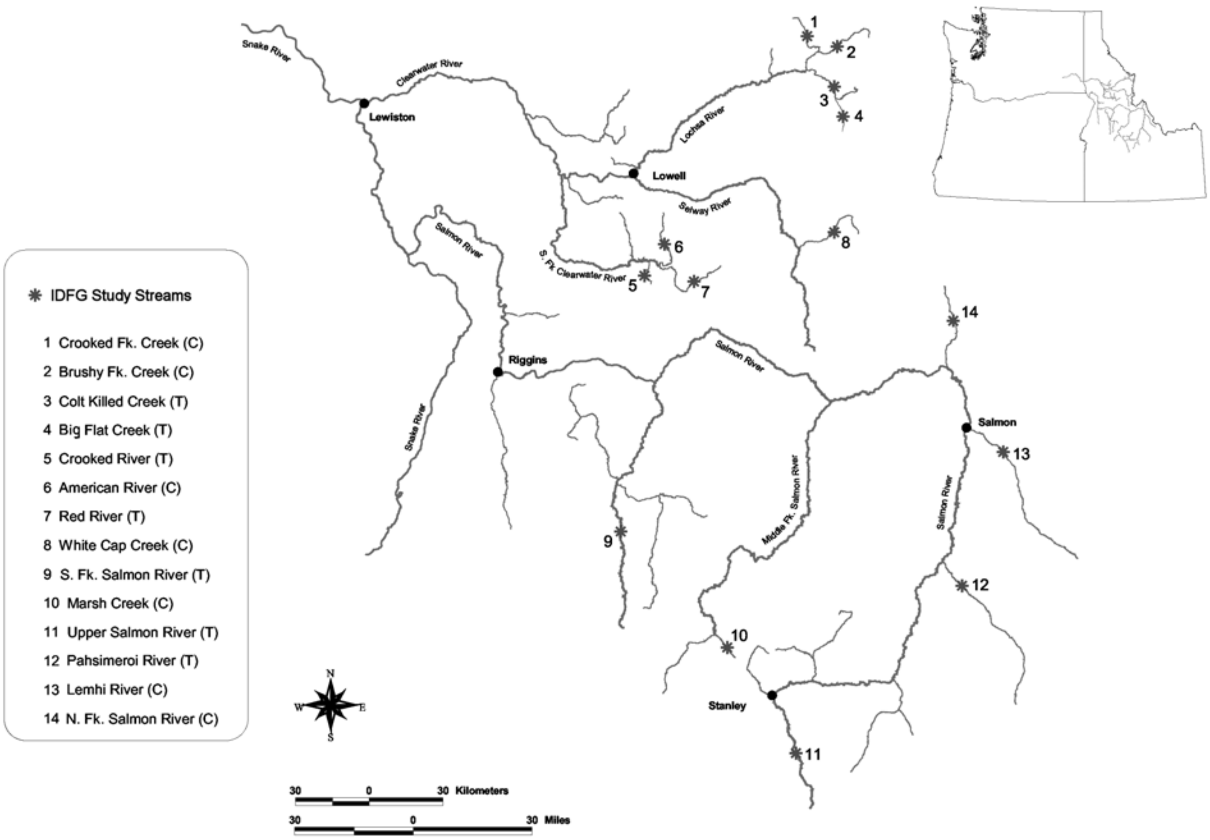


Figure 1. Treatment and control streams managed by the Idaho Department of Fish and Game for the Idaho Supplementation Studies.

METHODS

Supplementation Broodstock

From 1997-2001, broodstock management for the ISS utilized hatchery origin and naturally produced adults to construct supplementation broodstock for most years. As prescribed in Bowles and Leitzinger (1991), hatchery adults returning from F_1 and F_2 supplementation releases have been spawned with naturally produced fish since 1995. Supplementation broodstocks were developed at six locations for IDFG managed streams. These include:

Salmon Subbasin Satellite Facilities

- McCall Fish Hatchery—South Fork Salmon River
- Pahsimeroi Fish Hatchery—Pahsimeroi River
- Sawtooth Fish Hatchery—Upper Salmon River

Clearwater Subbasin Hatchery Facilities

- Crooked River
- Red River
- Powell—Colt Killed Creek

Hatchery methods used for capturing and spawning adult Chinook salmon and rearing juveniles for the ISS study followed accepted standard practices (for an overview of standard methods, see Leitritz and Lewis 1976; Piper et al. 1982; Erdahl 1994; Bromage and Roberts 1995; McDaniel et al. 1994; Pennell and Barton 1996). As the lead agency for ISS, the IDFG coordinated directly with hatchery and culture facilities to manage broodstock construction and supplementation releases.

In treatment streams containing weirs, natural escapement was the driving force for determining how many adults were selected for constructing supplementation broodstock. The study design established criteria for releasing a minimum of two-thirds of natural returning adults in ISS study reaches to spawn naturally. As such, no more than 33% of these adults were retained in the hatchery. Each brood year, sufficient numbers of adults of natural and supplementation origin that arrived at the hatchery were retained and spawned in the hatchery to produce juveniles for supplementation releases in numbers equivalent to what was expected to be produced by natural spawning in the stream in the same brood year. Thus, assuming that survivals for subsequent life stages of naturally produced fish was equal to or greater than comparable life stage survival of supplementation fish, hatchery origin adults returning to treatment streams would not exceed the naturally produced component.

Study participants recognized that in some years construction of localized broodstock would likely be compromised from low adult returns using the aforementioned strategy. However, the broodstock management component of the ISS is based on natural production and genetic conservation theory rather than conventional hatchery guidelines.

Treatments

The ISS study uses both juvenile and adult life stages to fully compliment supplementation for each treatment stream. First, juveniles from locally created broodstocks are uniquely marked and released into ISS treatment streams using different life stages at some prescribed numerical level. As these hatchery origin adults return to the stream they were released into, they are intercepted using hatchery weirs, identified, then passed upstream to supplement natural spawning. For this report, we define three biologically distinct life stages for juvenile treatment: 1) summer parr that are released in July and August as age-0, 2) presmolts that are released as zero age fish during September and October, and 3) smolts that are released the following spring (March through April) as age-1. We document ISS treatment by reporting juveniles released from 1997-2001 and adults released for natural spawning in return years 1997-2001.

The original treatment schedule prescribes smolt releases in the American River, Lemhi River, Pahsimeroi River, South Fork Salmon River, and Upper Salmon River. Presmolts were scheduled for release in Crooked Fork Creek, Crooked River, and Red River. Colt Killed Creek and Big Flat Creek were to be treated using parr. However, due to adaptive management decisions based primarily on the availability of broodstock, some of these prescribed treatments have changed from the original study design. Changes occurring from 1997-2001 are documented in the results section of this report.

For each treatment, we used a combination of fin clips (ventral and adipose) and coded-wire tags to uniquely mark all groups of supplementation juveniles for the purpose of distinguishing them from other hatchery origin and naturally produced Chinook salmon. A minimum of 500 smolts and 600 parr were PIT tagged to estimate survival between time of release and detection at the lower Snake River dams. Juveniles for supplementation releases were reared, marked, and PIT tagged at the McCall Fish Hatchery, Pahsimeroi River Hatchery, Sawtooth Fish Hatchery, and Clearwater Anadromous Fish Hatchery. Juveniles were typically outplanted within ISS study reaches, although in Crooked River, Pahsimeroi River, Red River, and the South Fork Salmon River juveniles were also volitionally released from on-site acclimation ponds.

The overall design of the ISS also considers natural spawning of supplementation origin adults as treatments. During phases II and III, most of the adult returns that originate from supplementation releases are permitted to enter natural spawning areas and spawn freely with each other or with adults produced from natural spawning. In treatment streams containing weirs, the numbers of natural and hatchery origin fish that are permitted upstream to spawn are recorded. In treatment streams lacking weirs, total spawning escapement is indexed from systematic redd counts in sites that are consistently surveyed every year. The proportions of natural and hatchery origin fish in the spawning escapement are estimated based upon the proportions of marked supplementation and unmarked natural origin carcasses recovered during spawning ground surveys.

Evaluation Points

Monitoring procedures that are intended to provide a means for evaluating natural production and productivity response to supplementation were collected on a stream-by-stream basis. For purposes of this report, we present the specific evaluation points prescribed in the original study design and the data that have been collected for the study streams mentioned above.

Adult Escapement

Adult Returns to Weirs—Escapement weirs designed to capture, enumerate, and manage adult Chinook salmon returning to ISS study streams were operated in the South Fork Salmon River, Pahsimeroi River, upper Salmon River, Crooked River, Red River, and Crooked Fork Creek. Data were collected on fork length, external marks or tags, sex, and disposition. Trapped adults were retained in the hatchery and spawned for broodstock purposes, culled, or placed upstream to spawn naturally.

Escapement protocols and criteria for ISS treatment were applied to treatment streams containing escapement weirs. Naturally produced adults were released above weirs to spawn naturally. In most cases, supplementation origin adults were released upstream at a level that numerically did not exceed the wild/natural component as part of the ISS experimental design. A proportion of both groups were retained for the purpose of creating ISS broodstock. In most cases, non-ISS hatchery origin Chinook salmon that were intercepted at weirs were retained for general production broodstock or recycled into a salmon fishery.

Adult escapement was managed primarily in treated streams because few control streams contained weirs. However, beginning in 1998 a weir was constructed on Crooked Fork Creek approximately ½ km upstream of its confluence with Colt Killed Creek for the purpose of intercepting hatchery Chinook salmon that stray from the Powell satellite facility located 100 m downstream of the Crooked Fork Creek/Colt Killed Creek confluence.

Redd Counts—We counted Chinook salmon redds during annual spawner surveys in each study stream from mid-August through October to estimate spawning escapement. Since precise measures of production are critical to the evaluation of ISS, we attempted to maintain the survey reaches reported in Walters et al. (1999) that were originally extended beyond the standardized IDFG redd trend areas. Most streams were surveyed in ISS index areas two or three times using ground counts (Hassemer 1993). One-time aerial surveys were conducted on other streams.

Methods for counting redds were consistently applied in most years. Multiple ground surveys were used to count redds for all years in American River, Crooked River, Lemhi River, Marsh Creek, Pahsimeroi River, Red River, and South Fork Salmon River. Single aerial counts were completed each year for the upper Salmon River.

Redds observed during ground surveys were flagged, assigned a unique number to avoid duplicate counts, and recorded on U.S. Geological Survey topographic maps. Beginning in 2000, redd locations were also recorded using Global Positioning System units. When a redd was identified, the observer determined whether the redd was complete or in progress. Adult Chinook salmon on or near the redd site were also recorded. Hiatus periods between counts generally lasted 7-10 days. Flagging was removed during the last ground count.

Although statistical evaluation of ISS is not presented in this report, we expressed redd data as redds per kilometer to more accurately portray trends in adult escapement during this report period. For an evaluation and statistical treatment of ISS, see Lutch et al. (2003).

Carcass Recoveries—Data were collected from Chinook salmon carcasses to determine their origin (hatchery or naturally produced) and ocean age. Sex, fork length, mid-eye to hypural length, presence of external marks or PIT tags, date, and stream name were recorded. In most areas, carcasses were tested for coded-wire tags by either collecting snouts for laboratory analysis or by scanning fish with detectors in the field. The ventral cavities of carcasses were also visually inspected to determine the degree of egg retention. Several structures were collected for age and DNA analysis using methods outlined in Kiefer et al. (2002). The caudal fin was removed to negate repetitive sampling.

Juvenile Emigration

For this report, we document juvenile emigration two ways. First, we report specific trap operations for each calendar year. This includes the calendar dates that define the trapping period and the number of days traps were operated. Secondly, we estimate brood year production from 1995 through 1999 using numbers of juveniles trapped, marked, and recaptured during migration years 1996 through 2001. Brood year production estimates for 2000 will be provided in the future as more data are collected.

Trapping—We used a combination of rotary-screw and motorized inclined scoop traps on 10 study streams to collect emigrating juvenile Chinook salmon (Table 2). Fish were marked with PIT tags to estimate abundance of both spring and fall emigrants and to provide minimum survival rates to the lower Snake River hydroelectric complex. Trapping data also provided additional life history information, such as length structure and emigration timing. Traps were installed in March and were operated daily through the summer and fall months. Traps were positioned in the thalweg of each stream when possible. During periods of high water, traps were inspected several times during the day and evening and removed from the thalweg during extremely high flows. During low water periods, flows were directed towards the center of the traps using temporary rock fykes.

Juvenile Chinook salmon were captured daily unless mechanical failures, high flows, debris, or ice prevented trap operation. Each morning, fish removed from the traps were anesthetized in buffered Finquel® MS-222, interrogated for PIT tags, weighed to the nearest 0.1 g, and measured for fork length (mm). A subsample (typically 30 fish/day) of Chinook salmon greater than 60 mm fork length was marked with PIT tags according to procedures described by Kiefer and Forster (1991) and the PIT Tag Steering Committee (1992). Fish showing obvious signs of stress (e.g., descaling, poor equilibrium) were not tagged but released downstream of the trap. After tagging, juveniles were either released after recovery or held in live boxes approximately 0.1-1.0 km upstream from the trap and released at dusk. A goal of tagging 700 summer, 500 fall, and 300 spring wild/natural emigrants per stream was targeted (Bowles and Leitzinger 1991). Data (species, length, weight) were also collected on non-target species to assist other projects. Physical data, such as weather conditions, staff gauge height, and stream temperatures were also recorded daily.

Table 2. Locations of juvenile Chinook salmon traps on Idaho Supplementation Studies streams and years of operation from 1997-2001.

Study Stream	Trap Type	Trap Location	Years Operated
Clearwater River basin			
Crooked Fork Cr.	Rotary screw	3.2 km upstream from mouth	1997-2001
Colt Killed Cr.	Rotary screw	0.2 km upstream from mouth	1998-2001
American R.	Rotary screw	1.9 km upstream from mouth	1998-2001
Crooked R.	Scoop trap/Rotary screw	0.9 km upstream from mouth	1997-2001
Red R.	Rotary screw	5.4 km upstream from mouth	1997-2001
Salmon River basin			
South Fork Salmon R.	Rotary screw	Knox Bridge	1997-2001
Marsh Cr.	Rotary screw	0.25 km upstream from confluence with Capehorn Cr.	1997-2000
Lemhi R.	Rotary screw	0.2 km upstream of Hayden Cr.	1997-2001
Pahsimeroi R.	Rotary screw	Directly below weir at Pahsimeroi Hatchery	1997-2001
Upper Salmon R.	Rotary screw and Scoop trap	Sawtooth Hatchery intake	1997-2001

Abundance Estimates—We used the Gauss software developed by Dr. Kirk Steinhorst, Division of Statistics, University of Idaho to estimate trap efficiencies and abundance of juvenile Chinook salmon migrating past the traps (Hong 2002; Steinhorst et al. in review). This program uses the Lincoln-Petersen estimator and modifications (e.g., Bailey's estimator) for calculating abundance and the profile and bootstrap methods for calculating confidence intervals. For this report, we apply the Bailey estimator to reduce bias and compute 90% confidence intervals with the bootstrap method (Steinhorst et al. in review).

The daily numbers of captured, marked, and recaptured fish are used to estimate efficiency, with the assumption that marked fish are released far enough upstream to permit random mixing with unmarked juveniles. However, because the population is not closed and two different probabilities exist for capturing marked and unmarked fish, Gauss uses an iterative solution to calculate the abundance estimate (Steinhorst 2000). When enough iterations are run (typically 1000), the estimates stabilize and the maximum likelihood estimate is obtained.

For brood year abundance estimates, we first stratified our juvenile data and estimated presmolt (fall trapping period) and smolt (spring trapping period) abundance. These point estimates were then summed to determine the number of brood year specific juveniles that emigrated from each stream. In most cases, smolts and presmolts were easily discernable using length distribution data and PIT tag interrogations. We then determined 90% confidence intervals for brood year estimates based on the percentiles of the bootstrap distribution (Steinhorst 2000). We present all of the estimates regardless of the number of recaptures. However, at least three to four recaptures are needed to decrease the chance of statistical bias in the estimate (Ricker 1975).

Precocious male Chinook salmon caught in traps were not included in emigrant estimates. Chinook salmon fry caught during the spring trapping season were not included either, as they were too small to tag for trap efficiency estimates.

PIT Tag Detections

We obtained PIT tag interrogation data from the Columbia River Basin PIT Tag Information System (PTAGIS) database to document the number of detections of supplementation origin and naturally produced juvenile Chinook salmon that were PIT tagged for the ISS. The PTAGIS reports provided by the Pacific States Marine Fisheries Commission contain information on tagging and release dates, capture method, species, fork length, release site, and interrogation site. Detection facilities located on the Lower Snake and Columbia River dams were used as evaluation points for ISS to reflect the variable conditions that affect juvenile performance upstream of the four lower Snake River dams. For this report, we focused on the timing and trends in the number of detections for each brood year of hatchery origin and naturally produced PIT tagged smolts arriving at Lower Granite (LGR), Little Goose, Lower Monumental, or McNary dams. Interrogating hatchery fish from treatment streams and natural fish from treatment and control streams enables ISS researchers to evaluate hatchery supplementation while determining the performance of hatchery juveniles relative to natural fish.

We first queried the PTAGIS database for each study stream by migratory year for information on detection numbers at the four lower Snake River dams. Data were sorted to determine the first unique detection at each dam site. Unique detections from interrogation sites below LGR were summed with those at LGR to obtain the total number of detected fish that reached LGR. Because it is likely that at least some PIT tagged fish go undetected at all four dams, cumulative detections are considered minimum for this report. Passage timing of 10%, 50%, and 90% of each release group was calculated from frequency distributions of detection dates at LGR.

We report PIT tag interrogations for supplementation and naturally produced juvenile Chinook salmon for brood years 1995-1999. Both groups were interrogated and reported separately. For naturally produced fish collected and tagged in the American River, Colt Killed

Creek, Crooked River, Crooked Fork Creek, Marsh Creek, South Fork Salmon River, and the Upper Salmon River, we report presmolts as juveniles tagged as age-0 in summer and fall that were detected the following spring, and smolts as fish tagged as age-1 and detected in the same year. We confirmed these life stages by plotting 1997-2001 PIT tag and interrogation data (Figure 2). In these streams, life history strategies are typical of spring/summer Chinook salmon in Idaho in that juveniles rear in fresh water for a period of one year, then complete their seaward migration the following spring as age-1. Presmolts migrating from ISS study reaches are typically moving downstream in search of wintering areas prior to smolting the following spring.

The Pahsimeroi River and Lemhi River were treated differently with respect to differentiating life stage and their associated emigration period because we anticipated interrogating two different smolt groups emigrating from these rivers from the same brood year (Figure 3). The first smolt group would be composed of a portion of the summer parr tagged in year “x” that will likely be detected at LGR as age-0 the same year, and the second group would be composed of the remaining PIT-tagged fish from that same group that would be detected as age-1 fish the following spring (year “x+1”). To differentiate the life history stages defined above, we applied a discriminate analysis function using data from 1997–2001 to predict the proportion of summer tagged juveniles that would potentially emigrate as smolts the same year and as age-1+ fish the following spring (Johnson and Wichern 1992). Interrogations in years x and x+1 from this group were used as independent variables, and the tagged fish represented the dependent variable. The prediction model was then applied to all PIT-tagged individuals from the summer group.

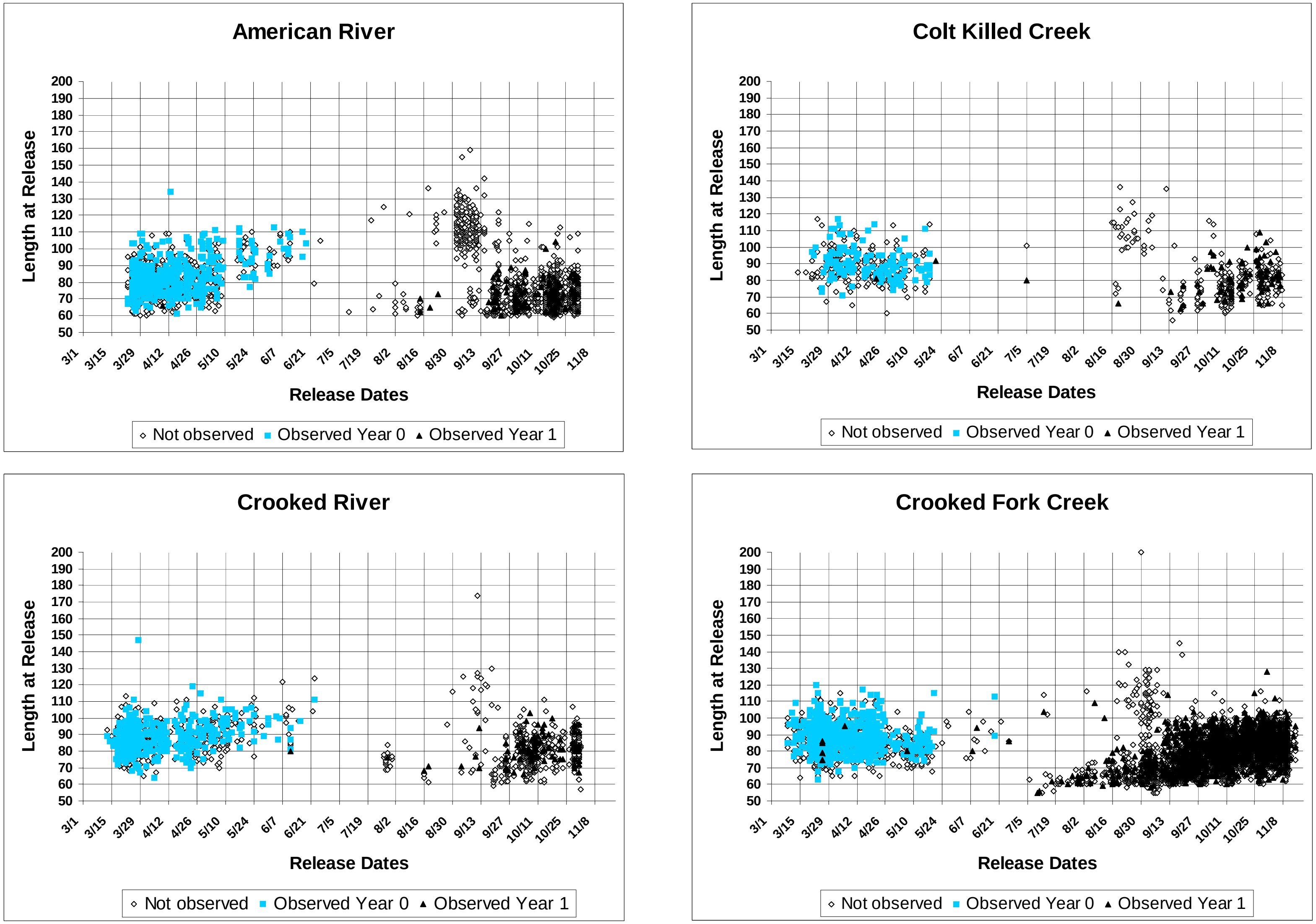
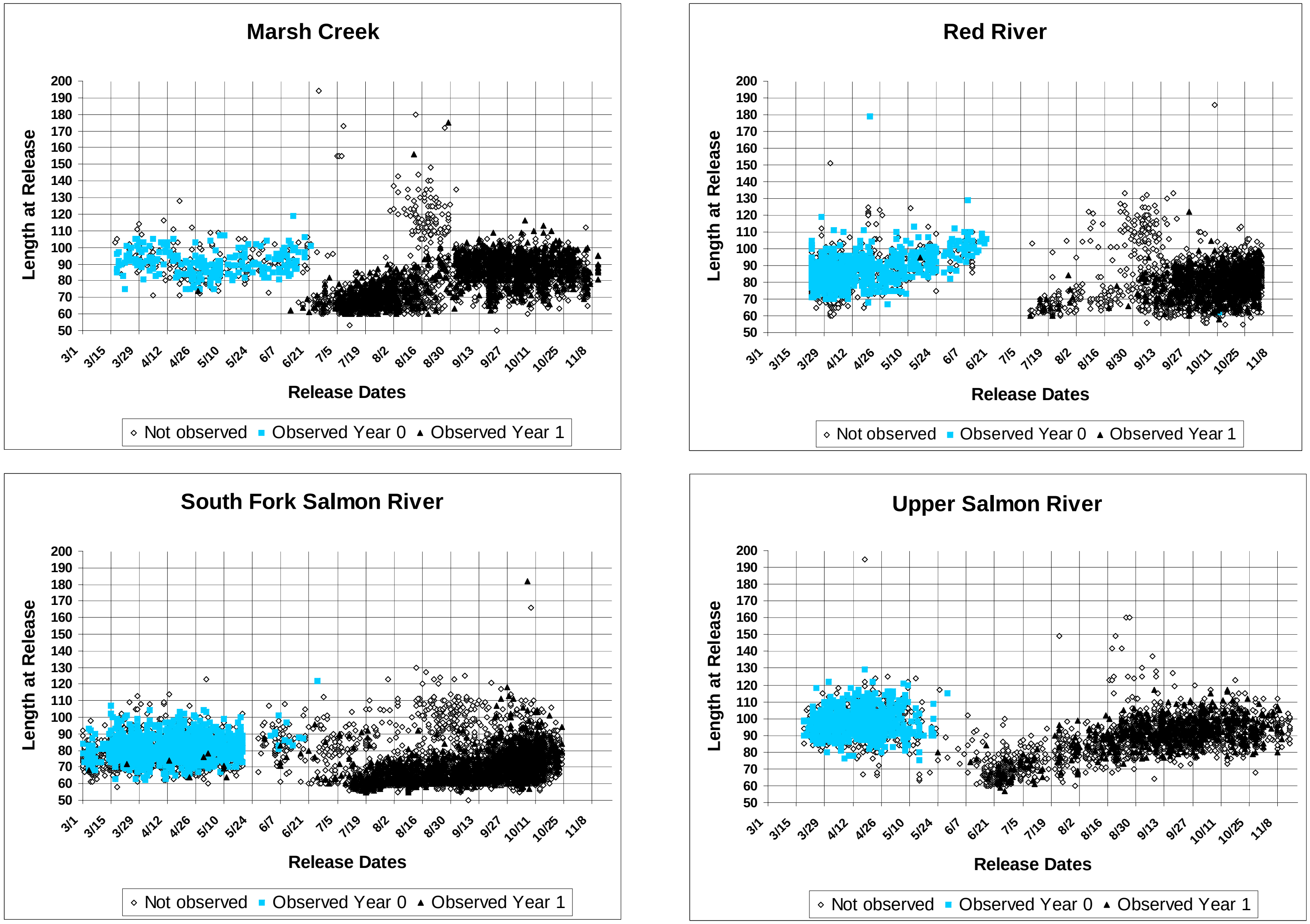


Figure 2. PIT tag detections of out-migrating juvenile Chinook salmon at the Lower Snake River dams that were tagged in eight streams managed by the IDFG from 1997 – 2001. Not observed = juveniles tagged but not detected; Observed Year 0 = fish tagged and detected the same year; Observed Year 1 = fish tagged that were detected the following year.



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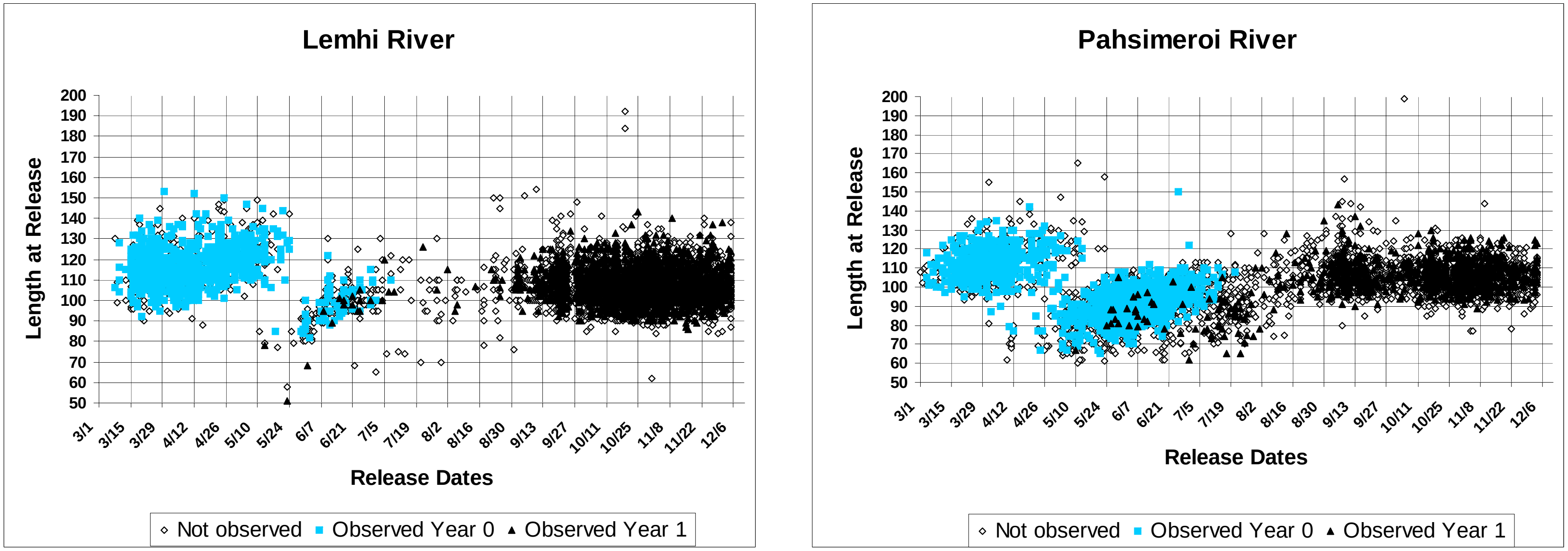

Figure 3. PIT tag detections of out-migrating juvenile Chinook salmon at the Lower Snake River dams that were tagged in the Lemhi River and Pahsimeroi River from 1997-2001. Not observed = juveniles tagged but not detected; Observed Year 0 = fish tagged and detected the same year; Observed Year 1 = fish tagged that were detected the following year.

RESULTS

Broodstock Management

From 1997 through 2001, supplementation broodstocks were constructed from locally returning adult Chinook salmon in Crooked River, Red River, Pahsimeroi River, South Fork Salmon River, and the Upper Salmon River. In Colt Killed Creek, ISS broodstocks were created from adults returning to Walton Creek, which supplies the Powell satellite facility located 100 m downstream of the mouth of Colt Killed Creek. Furthermore, broodstocks were not constructed for Colt Killed Creek during 1998 and 1999 because of low adult returns.

Treatments

Juvenile Chinook salmon were released for ISS into treatment streams from April 1997 through September 2001 (Appendix A). Twenty-eight of the 35 prescribed treatments were completed. In Bowles and Leitzinger (1991), American River and Crooked Fork Creek were scheduled for treatment during Phase II but were programmatically changed to control streams by 1996. Alturas Lake Creek was not treated in any year and will likely be excluded from the study design since it also lacks monitoring data for adult escapement and juvenile production.

Specific life stages released in some treatment streams were inconsistent with the experimental design, often as a result of logistical constraints in rearing and release. In Crooked River, brood year 1999 fish were released as parr rather than presmolts. In spring of 1998, Red River received smolts rather than the prescribed presmolt release the previous fall.

The South Fork Salmon River received additional treatments as parr that were volitionally released from Stolle Ponds beginning with brood year 1997. This expanded treatment was prescribed to expand the current range of the spawning aggregate in the South Fork Salmon River by rearing and releasing juveniles upstream of and within suspected spawning habitats (Sankovich and Hassemer 1999).

Adult Escapement

Adult Returns to Weirs

Several different Chinook salmon origin types returned to weirs from 1997-2001 (Appendix B). Nearly all the adults were identified as either hatchery supplementation, general production, or naturally produced. Hatchery supplementation and naturally produced salmon are considered part of the ISS study, and the ratio of these two groups returning to ISS study streams varied from year to year. However, adult returns from natural production were typically higher than from supplementation broodstock.

Adult escapement varied widely within and among study streams during the reporting period. For example, in the upper Salmon River we documented 182 adults returning in 1997 versus 1,674 returning in 2001. The largest escapement estimate was recorded in the South Fork Salmon River in 2001 with 2,644 Chinook trapped at the McCall Hatchery facility. In contrast, only four adults were counted at Crooked River weir in 1999.

As prescribed in Bowles and Leitzinger (1991), supplementation origin and naturally produced adult Chinook salmon were passed above the hatchery weirs to spawn naturally (Table 3). However, in some years release criteria was inconsistent with the study design. In the South Fork Salmon River during 1997 and 1998, the number of hatchery (supplementation) Chinook salmon released upstream of the McCall satellite hatchery facility exceeded the wild/natural component. In 2000, general production adults were passed upstream of the weir to spawn naturally due to lack of returning supplementation adults. Colt Killed Creek, unlike most treatment streams, contains no weir to enumerate and manage adult escapement. Therefore, the prescribed proportion of hatchery supplementation fish among natural spawners may be exceeded. Furthermore, significant straying of non-ISS hatchery adults is expected from hatchery origin juveniles released from the Powell satellite hatchery facility that operates just below the mouth of Colt Killed Creek.

Table 3. Hatchery origin and naturally produced Chinook salmon passed above escapement weirs for each of the Idaho Department of Fish and Game assigned treatment streams, 1997-2001 (includes jacks).

		Supplementation Origin				Wild Natural Origin			
Treatment Stream	**Year**	**Males**	**Females**	**Unknown**	**Total**	**Males**	**Females**	**Unknown**	**Total**
Pahsimeroi River	1997	11	11	0	22	32	18	0	50
	1998	20	8	0	28	24	28	0	52
	1999	73	37	0	110	40	27	0	67
	2000	12	23	0	35	41	22	0	63
	2001	66	77	0	143	84	79	0	163
Upper Salmon River	1997	4	3	0	7	65	40	0	105
	1998	4	5	0	9	39	44	0	83
	1999	43	6	0	49	57	16	0	73
	2000	-	43	0	43	366	116	0	482
	2001	410	202	0	612	364	255	0	619
SF Salmon River	1997	186	163	0	349	118	74	0	192
	1998	104	92	0	196	60	58	0	118
	1999	34	22	0	56	137	79	0	216
	2000	295[a]	13[b]	0	475	542	103	0	645
	2001	475	283	0	759	1075	599	0	1674
Crooked River	1997	39	47	0	86	13	27	0	40
	1998	0	0	37	37	0	0	42	42
	1999	51	0	0	51	3	1	0	4
	2000	81	95	1	177	47	19	6	72
	2001	14	9	0	23	167	191	2	360
Red River	1997	10	7	0	17	24	16	0	40
	1998	0	0	14	14	1	0	21	22
	1999	21	0	0	21	2	1	0	3
	2000	4	1	0	5	16	11	1	28
	2001	8	15	0	23	115	88	2	205

[a] An additional 83 male general production adults were released for natural spawning.
[b] An additional 84 female general production adults were released for natural spawning.

Redd Counts

Redd counts reflected annual variation in adult escapement in each study stream. For example, we counted 110 redds in Marsh Creek during 2001 but found no redds in 1999. Similarly, no redds were observed in Colt Killed Creek in 1999, but 113 were counted in 2001. The South Fork Salmon River had the highest number of observed redds with 493 counted in 2001. On average, the lowest counts were recorded in Big Flat Creek, averaging only seven redds observed per year. Redd counts are summarized in Appendix C.

Notable inconsistencies in the redd count data set from 1997-2001 are also documented. In the Clearwater River subbasin, the upper 6.9 km of White Cap Creek was not surveyed during 1999 due to mechanical problems with the aircraft. No counts were performed in Big Flat Creek in 1998 and 1999. A combination of single pass ground and aerial counts were completed on Colt Killed Creek through 2000 and then expanded to multiple ground counts the following year. In the Salmon River subbasin, nearly 50% of the ISS index reach in the North Fork Salmon River in 2000 was not surveyed. In addition, survey reaches were expanded in the Pahsimeroi River, South Fork Salmon River, and Colt Killed Creek.

Carcass Recoveries

We summarized Chinook salmon carcass data by stream, return year, and sex from 1997-2001 for both hatchery origin and naturally produced fish (Appendix D). Carcass data were collected each year from Brushy Fork Creek, Crooked Fork Creek, Crooked River, Lemhi River, Pahsimeroi River, and the South Fork Salmon River. No carcasses were recovered from American River, Marsh Creek, and the North Fork Salmon River in 1999. Study streams that were not surveyed for carcasses include Big Flat Creek (1998 and 1999), Colt Killed Creek (1998 and 1999), the upper Salmon River (1997-1999, 2001), and White Cap Creek for all years because spawning surveys were completed from aircraft.

Several different mark types were recorded from carcasses recovered in ISS study reaches. Most of these were either naturally produced (unmarked) supplementation adults marked with ventral fin clips or with coded-wire, or general production adults distinguishable by a missing adipose fin. General production adults were recovered in most streams but were more evident in treated streams (Appendix D). In streams and/or years where coded-wire was used to distinguish supplementation fish, some of these data are not yet available.

Chinook Salmon Spring Emigrants

Juvenile emigration traps were operated in streams managed by the IDFG during most years. Screw traps at American River and Colt Killed Creek were installed and operated beginning in 1998 to estimate brood year 1997 out-migration. The screw trap was not operated in Marsh Creek during the summer and fall of 2000 and the spring of 2001 because no adult returns were documented the previous year. Crooked River and the upper Salmon River contained the only mechanized scoop trap used to collect, tag, and estimate juvenile emigration. Most of these traps were installed soon after ice-off in mid March and operated through November or until freezing conditions prevented daily operation. Trapping operations for calendar years 1997-2001 are presented by stream in Appendix E.

The position of juvenile traps remained fairly constant in most streams. Trap efficiencies were likewise consistent with previous years (Walters et al. 1999). For all stream years of data, trapping efficiencies ranged from 4% to 35%. These estimates varied in some streams across the years that were sampled. For example, estimates in the Pahsimeroi ranged from 4% in 1997 to 29% in 2001. Efficiency estimates for trapping smolts were consistently higher than presmolt estimates.

Population Estimates of Juvenile Chinook Salmon

We estimated abundance of naturally produced juvenile Chinook salmon emigrating past screw traps for most brood years from 1995-1999 (Appendix F). The highest total juvenile production estimates were from American River (495,431 juveniles from brood year 1997), followed by the South Fork Salmon River, Red River, and Crooked Fork Creek. On average, production was lowest in Colt Killed Creek.

Life History of Emigrating Juvenile Chinook Salmon

We observed variable life history and migration timing of spring and summer Chinook juveniles across streams. Most notable was the difference in emigration timing and growth. In the South Fork Salmon River, a significant proportion of the juveniles measuring between 40 and 60 mm fork length emigrated as fry in May and June. Similar patterns were observed in Crooked Fork and Colt Killed creeks. In contrast, juveniles from the Pahsimeroi, Lemhi, and upper Salmon Rivers emigrating in May and June are much larger, ranging from 60-90 mm fork length. In the Pahsimeroi and Lemhi Rivers, many of the age-0 juveniles emigrating from May through July are subsequently detected the same year at PIT tag interrogation sites on the lower Snake and Columbia River hydroelectric facilities. Other juveniles of the same brood year migrating during this time are interrogated the following spring as age-1 smolts. We have not observed this life history adaptation in any of the other ISS study streams.

Interrogations

The number of naturally produced juveniles PIT tagged and detected at the lower Snake River dams from brood years 1995-1999 are presented for most streams in Appendix G. Detections for ISS hatchery Chinook PIT tagged and released in treatment streams are summarized in Table 4. We PIT tagged adequate numbers of juvenile Chinook salmon in most streams for the purpose of interrogating these at the lower Snake River dams so that precise juvenile survival estimates can be obtained. Missing years are limited to a few estimates for naturally produced unknown groups that were emigrating in 2001. On average, a higher proportion of naturally reproduced presmolts were PIT tagged than any other life stage. These numbers varied considerably from year to year within each stream. For example, in the South Fork Salmon River, we PIT tagged more than 3,500 presmolts from brood year 1998 but only 993 from brood year 1995. For supplementation broodstock, we averaged 600 PIT tagged fish per release (Table 4).

Most PIT-tagged fish that were naturally produced were detected from April through July as age-1 juveniles. These were largely age-1 smolts tagged from March through May the same year and presmolts tagged as age-0 the previous year in summer and fall.

In the Pahsimeroi and Lemhi rivers, age-0 juveniles tagged in the summer were interrogated at the dams the same migratory year (Appendix H). This pattern is consistent for the five years of trapping operations presented in this report and is similar to analyses conducted in previous years.

Differences in juvenile migration and detection rates occurred between hatchery origin and naturally produced Chinook salmon. Naturally produced smolts were detected at a higher rate than hatchery supplementation fish. Emigration profiles of naturally produced Chinook salmon were comparable in most streams. However, juveniles from the American River required nearly 25 additional days for 90% of all life stages to pass the lower Snake River hydroelectric complex. In addition, detection rates were higher for juveniles PIT tagged as smolts than as presmolts.

Table 4. Detections of PIT tagged juvenile Chinook salmon from hatchery supplementation broodstock (brood years 1995-1999) released in streams managed by the Idaho Department of Fish and Game. Number detected is the total number of unique detections from one of the four lower Snake River hydropower detection sites (Lower Granite, Little Goose, Lower Monumental, and McNary). NR = no releases.

Stream	Brood Year	Life Stage	Number PIT Tagged	Number Detected	First Detection	Number Detected at Lower Granite Dam	10% Passage at Lower Granite Dam	50% Passage at Lower Granite Dam	90% Passage at Lower Granite Dam
Clearwater River Basin									
Colt Killed Creek	1999		NR						
	1998		NR						
	1997	parr	1906	56	4/20/99	14	May 3	June 13	July 8
	1996		NR						
	1995		NR						
Crooked River	1999	presmolt	499	40	4/14/01	34	Apr 17	May 5	June 24
	1998	parr	NT						
	1997	presmolt	697	27	4/12/99	9	Apr 16	May 24	June 18
	1996		NR						
	1995		NR						
Red River	1999	presmolt	500	44	4/7/01	31	Apr 24	May 9	June 16
	1998	presmolt	NT						
	1997	presmolt	704	15	4/9/99	5	Apr 23	June 8	June 20
	1996	smolt	1000	618	4/18/98	358	Apr 25	May 3	May 9
	1995	smolt	NR						
Salmon River Basin									
South Fork Salmon River	1999	smolt	600	382	4/27/01	318	Apr 29	May 13	May 18
		parr	598	45	4/28/01	43	May 12	May 19	June 10
	1998	smolt	600	244	4/16/00	146	Apr 30	May 7	May 16
	1997	smolt	593	265	4/30/99	93	May 13	May 24	June 9
		parr	967	82	4/21/99	29	Apr 21	May 24	June 18
	1996	smolt	NT						
		parr	44	6	4/30/98	5	Apr 29	June 4	July 6
	1995	smolt	1000	232	4/22/97	110	Apr 29	May 6	June 15
Pahsimeroi River	1999	smolt	500	276	4/29/01	224	May 1	May 10	May 15
	1998	smolt	500	184	4/21/00	107	Apr 24	May 4	May 11
	1997	smolt	500	241	4/23/99	108	Apr 29	May 11	May 19
	1996	smolt	NR						
	1995	smolt	999	315	4/25/97	147	May 4	May 14	May 22
Upper Salmon River	1999	smolt	500	256	5/1/01	197	May 4	May 13	May 15
	1998	smolt	1004	378	4/23/00	214	Apr 27	May 4	May 11
	1997	smolt	991	260	4/27/99	71	May 7	May 17	May 24
	1996	smolt	499	248	5/1/98	139	May 4	May 8	May 15
	1995	smolt	1494	454	4/27/97	245	May 6	May 16	May 29

DISCUSSION

Treatment

Complete treatment of ISS study streams using locally adapted hatchery broodstocks is an integral part of evaluating the effectiveness of supplementation at rehabilitating Chinook salmon populations. In this report, we documented successful efforts from 1997 through 2001 in maintaining annually prescribed treatments in most streams managed by the IDFG. For example, the South Fork Salmon River, Pahsimeroi River, upper Salmon River, and Red River all received brood year releases from 1994-1999. These results are encouraging, particularly when one considers the precariously low returns of adult Chinook salmon to Idaho in the early to mid 1990s.

Deviations from original treatment goals with respect to the number and life stage of juveniles released per stream may be problematic as we begin to evaluate treatment effects on natural production and productivity during the final study phase. Insufficient quantities of juvenile Chinook salmon may prevent robust statistical evaluation of treatment effects. Furthermore, low replication of juvenile releases by life stage may compromise evaluation of supplementation release strategies. However, a recent statistical review and treatment of ISS data demonstrated a significant effect of supplementation in some streams (Lutch et al. 2003). Although life stage specific releases were not examined, these results suggest ample statistical power when presented with low levels of treatment. Although cautionary, these findings are encouraging since additional treatment with juvenile outplants is expected through spring 2004 and adult returns through migratory year 2007 (Lutch et al. 2003).

Adult Escapement

Redd Counts

The ISS experimental design focuses on a comprehensive examination of the effects of hatchery supplementation on Chinook salmon populations. Natural production and productivity measures are used as evaluation points for qualitative and quantitative evaluation of the ISS. Presently, redd counts are our most complete data set for estimating adult escapement and programmatically evaluating production response to supplementation in all study streams managed by the cooperating agencies for the ISS. As we progress toward the final study phase, it is critical that we maintain comprehensive but precise redd count surveys for monitoring and evaluation of ISS.

We attempted to maintain precision by conducting multiple redd counts in most IDFG streams using the same methods applied in 1996. In the upper Salmon River, aerial surveys were completed and redds were estimated in the same study reach during similar times of year. Where annual survey reaches were inconsistent in length, the expanded reach was documented to enable redd data to be expressed as a function of stream length.

Our redd count data suggests increased adult escapement during Phase II of the ISS study. For example, we counted more redds in all streams during migratory year 2001 than in any other year of the study. As higher escapement occurs, we suspect that prescribed broodstock management and release protocols for the ISS will be achieved through Phase II (supplementation). This will enhance the analysis of the study because construction of locally adaptive broodstocks is the basis for evaluating supplementation with the ISS. Previous concerns of low adult escapement to ISS streams were warranted based on low hatchery production and the effect on proposed ISS treatment (Walters et al. 1999). Concurrently, adaptive management decisions were made, such as releasing juveniles as smolts to increase survival to adult return and outplanting general production adults in ISS streams for the purpose of achieving some type of treatment. Full treatment of ISS during Phase II will result in fewer deviations to the design, allowing for more robust analyses and more meaningful comparisons between treated and control streams.

Returns to Weirs

Using hatchery weirs to monitor adult Chinook salmon returning to Idaho provides ISS the opportunity to complete tasks associated with developing broodstock and managing adult escapement. From 1997-2001, returns were sufficient to collect gametes for locally adapted broodstocks and to release known origin adults upstream of weirs to spawn naturally in ISS study reaches. Adult escapement data were collected for select study streams that contain weirs. However, we recognize problems with the accuracy and precision of these estimates, namely because of the ineffectiveness of some weirs to intercept all returning adults. Variable flow regimes prevent installation of weirs under certain conditions, and this often occurs as adults are returning. Furthermore, using adult escapement data to statistically evaluate supplementation may be problematic due to the lack of estimates in control streams. Presently, the IDFG operates weirs on five treatment streams but only one control stream (Crooked Fork Creek). Even under the best flow conditions, we suspect that a substantial proportion of non-ISS hatchery adults escape from the adjacent Powell satellite hatchery into Crooked Fork Creek prior to installation of the weir. The limited adult escapement information is similarly evident across the ISS study. As a result, we recommend that age data be collected from all carcasses where escapement weirs are not present in order to reconstruct the adult return more accurately.

The Pahsimeroi River and Sawtooth Hatchery weirs are more effective in enumerating and managing escapement of adult Chinook salmon. Existing infrastructure at each of these facilities permits installation before adults begin to return. For example, in 2001 the weir at Pahsimeroi Hatchery was installed on May 29. The first Chinook salmon adult was not captured until June 6. Similarly, the Sawtooth Hatchery weir was installed five days before the first adults were trapped on May 28. We suspect that other weirs are less than 100 percent effective, because spring runoff events often preclude the installation of weirs prior to the arrival of the first adults, and/or weirs may not be effective in funneling adults to a trap structure. As a result, additional measures for estimating escapement at these locations should be considered.

The adult escapement and release data suggests that adequate supplementation origin adults returned to Crooked River, Pahsimeroi River, South Fork Salmon River, and the upper Salmon River for the purpose of supplementing natural spawning. As a result, a treatment effect on natural production might be expected from F_1 and F_2 adult returns through Phase III since the majority of these were passed upstream to spawn naturally with wild/natural origin Chinook as part of the ISS study design. However, a thorough evaluation of response between treatment and control streams will not be completed until more data are available.

As we approach the final study phase, we suspect that interim statistical evaluations of both natural production and productivity will be an integral component of ISS. This will enable us to critically review data sets for the purpose of meeting project objectives while providing the opportunity to adapt programmatically to challenges to the study design (e.g. incomplete data types, inadequate treatments, and management/research conflicts to the ISS study).

Carcass Surveys

Based on recent reviews of the ISS study, we recognize that collecting Chinook salmon carcass data is imperative for the evaluation of ISS. First, by examining recovered fish for marks, we can determine what origin types (hatchery vs. wild) were present in ISS study reaches. These data are important because they provide a quantitative estimate of the contribution of non-ISS Chinook salmon to natural production. Second, important age composition data can be obtained from adults for the purposes of reconstructing brood year returns and determining ocean age proportions of Chinook salmon returning to ISS study streams. Finally, in streams containing escapement weirs that are less than 100% effective, they provide an opportunity to estimate adult escapement using a mark recapture estimator.

We documented substantial numbers of general production adult Chinook salmon (distinguishable by a missing adipose fin) escaping into ISS study reaches in some IDFG managed streams. For example, in American River 209 general production adult Chinook salmon were recovered in 2001, which represented more than 50% of the annual composition. Nearly two-thirds of the adults recovered in the SF Salmon River in 1999 were of non-ISS origin. Clearly, this becomes problematic when we attempt to evaluate treatment effects from locally adapted supplementation broodstock. In a recent statistical treatment of ISS data, a statistical analysis that examined the potential effect of non-ISS Chinook salmon demonstrated an insignificant effect of straying for the evaluation of ISS. However, these results are based on a subset of streams due to incomplete carcass data in many streams, further emphasizing the need for intensified carcass surveys across all ISS study streams (Lutch et al. 2003).

<u>Juvenile Abundance</u>

Juvenile Trapping

Our methods for trapping juvenile Chinook salmon emigrating from ISS study reaches were consistent with Bowles and Leitzinger (1991). We PIT tagged a representative sample of parr, presmolts, and smolts across their migration period to estimate abundance and interrogate fish at the lower Snake River dams. Trap locations were consistent with previous years, which was reflected in the efficiency estimates for each stream. On several occasions, traps were not operated due to prohibitive flow conditions. However, this represented a small percentage of the total number of days traps were fishing.

Emigration Estimates

Juvenile Chinook salmon production estimated using screw traps in treated and control streams will be one of several evaluation points for measuring a response to treatment. As prescribed in the study design (Bowles and Leitzinger 1991), these estimates are appropriate for documenting production trends between treated and control study streams. However, we caution using them to reflect total production for several reasons. First, traps are not operated during periods when migration may be significant. High water events necessitate trap removal, particularly in spring when large amounts of debris are present. Secondly, newly emerged fry and parr that migrate past the traps in spring are too small to PIT tag (<60 mm fork length). Hence, individuals are counted, but the total abundance of this group cannot be estimated. Finally, we do not operate juvenile traps in the winter months. Although movement is likely small during this period, we expect that our methods are underestimating the total number of juveniles produced for a given brood year.

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ACKNOWLEDGEMENTS

Completion of this report would not have been possible without the collaborative assistance from the many cooperators of Idaho Department of Fish and Game. We acknowledge Jody Brostrom, Jon Hansen, and Jody Walters as former ISS project managers who contributed data for this report. We thank Bruce Barnett, Paul Bunn, Laurie Janssen, and Tim Klucken from the IDFG for supporting data compilation and preparation of figures and tables. We appreciate the efforts of the IDFG fish hatchery managers and their crews for managing adult escapement, supplementation broodstock, and outplanting activities for ISS. We also thank the many field personnel responsible for data collections. Cheryl Leben completed the formatting for this report, and Paul Bunn created the stream maps. Bonneville Power Administration provided funding for this project.

APPENDICES

Appendix A. Juvenile hatchery Chinook salmon releases for the ISS during the reporting period (1997-2001). NB = no supplementation broodstock constructed for the given release year.

Treatment Stream	Release Date	Number of Juveniles Released	Life Stage	Brood Year	Number PIT tagged	Mark[a]	Broodstock Source[b]	Rearing Facility[c]
Clearwater River Subbasin								
Crooked River	9/28/01	155,887	Presmolt	2000	500	LV		
	9/1/00	105,507	presmolt	1999	499	RV	LOOKGL	CAFH
	9/28/1999	89,298	parr	1998	0	LV	POW	CAFH
	9/24/1998	162,119	presmolt	1997	0	RV	SFC	CAFH
	NB			1996				
Red River	9/28/01	84,238	presmolt	2000	500	RV		
	Sept 00	68,684	presmolt	1999	500	LV	LOOKGL	CAFH
	9/27/1999	74,981	presmolt	1998	0	RV	POW	CAFH
	10/5/1998	66,114	presmolt	1997	0	LV	SFC	CAFH
	4/13/1998	29,585	smolt	1996	0	RV	RDR	CAFH
	04/7-9/98	21,623	smolt	1996	0	LV	RDR	CAFH
	NB			1995				
Colt Killed Creek	7/25/2001	298,848	parr	2000	700	LV	POW	CAFH
	NB			1999				
	NB			1998				
	7/15-8/5/98	299,079	parr	1997	2,100	AD	POW	CAFH
	NB			1996				
Salmon River Subbasin								
SF Salmon River	7/20/2001	46,981	parr	2000	600	CWT	SFS	MFH/ST
	3/27-3/29/01	88,154	smolt	1999	600	LV	SFS	MFH
	7/23-31/00	54,234	parr	1999	598	CWT	SFS	MFH/ST
	4/3-4/6/00	194,686	smolt	1998	600	RV	SFS	MFH
	4/5-8/99	126,937	smolt	1997	593	LV	SFS	MFH/ST
	8/3/1998	49,872	parr	1997	967	CWT	SFS	MFH/ST
	3/29-4/6/98	22,982	smolt	1996	0	E	SFS	MFH
	7/7-10/97	24,990	parr	1996	44	RV	SFS	MFH/ST
	3/19-21/97	63,355	smolt	1995	14,108	E	SFS	MFH
Pahsimeroi River	4/15-26/01	85,939	smolt	1999	500	CWT	PAR	PFH
	4/13-17/00	53,837	smolt	1998	500	AD	PAR	PFH
	4/14-19/99	135,699	smolt	1997	500	AD	PAR	PFH
	NB			1996				
	4/18/1997	122,017	smolt	1995	520	AD	PAR	PFH
Upper Salmon River	4/18/2001	57,134	smolt	1999	500	CWT	SAL	SFH
	4/12/2000	123,425	smolt	1998	1004	CWT	SAL	SFH
	4/16/1999	105,951	smolt	1997	0	CWT	SAL	SFH
	4/21/1998	43,161	smolt	1996	0	AD	SAL	SFH
	4/17/1997	4,650	smolt	1995	1,440	AD	SAL	SFH

[a] Mark: RV = right pelvic fin clip, LV = left pelvic fin clip, E = elastomer injection, AD = adipose fin clip, CWT= coded-wire tag.

[b] Broodstock sources: POW = Powell, SFS = South Fork Salmon River, PAR = Pahsimeroi River (summer run), SAL = Salmon River, LOOKGL = Looking Glass, SFC= South Fork Clearwater, RDR = Red River.

[c] Rearing Facilities: CAFH = Clearwater Anadromous Fish Hatchery, MFH = McCall Fish Hatchery, MFH/ST = McCall Fish Hatchery and Stolle Pond, PFH = Pahsimeroi Fish Hatchery, SFH = Sawtooth Fish Hatchery.

Appendix B. Number of adult Chinook salmon returning to ISS IDFG hatchery weirs. Adults are listed by their respective brood year and release group. Hatchery production fish are not included. BKD = Bacterial Kidney Disease.

		Juvenile Release Groups			Number of Returning Adults					
					Supplementation Origin			Natural Origin		
Stream	Return Year	Brood Year	Number Released	Mark[a] and Life Stage	Male	Female	Total	Male	Female	Total
Crooked River	1997	1994		RV strays	0	0	2	0	0	0
		1993	199,255	RV presmolt	0	0	65	0	0	32
		1993		LV strays	0	0	2	0	0	0
		1992		RV strays	0	0	1	0	0	6
		1992		LV strays	0	0	1	0	0	0
				TOTAL			**71**			**38**
	1998	1995		No Release	0	0	0	0	0	0
		1994		No Release	0	0	0	0	0	5
		1993	199,255	RV presmolt	0	0	37	0	0	37
				TOTAL			**37**			**42**
	1999	1996		No Release	0	0	0	0	0	2
		1995		No Release	0	0	0	0	0	1
		1994		No Release	0	0	0	0	0	1
				TOTAL			**0**			**4**
	2000	1997	162,119	RV presmolt	0	0	0	0	0	27
		1996		No Release	0	0	0	0	0	46
		1995		No Release	0	0	0	0	0	1
				TOTAL			**0**			**74**
	2001	1998	89,298	LV presmolt	0	0	0	0	0	4
		1997	162,119	RV presmolt	0	0	3	0	0	337
		1996		No Release	0	0	0	0	0	29
				TOTAL			**3**			**370**
Red River	1997	1994	24,002	RV smolt	0	0	0	0	0	1
		1993	79,747	LV presmolt	0	0	8	0	0	38
		1993		RV strays	0	0	20	0	0	0
		1992	14,275	RV presmolt	0	0	0	0	0	3
				TOTAL			**28**			**42**
	1998	1995		No Release	0	0	0	0	0	1
		1994	24,002	RV smolt	0	0	11	0	0	6
		1993	79,747	LV presmolt	0	0	3	0	0	15
				TOTAL			**14**			**22**
	1999	1996	21,623	LV smolt (low BKD)	0	0	12	0	0	1
		1996	29,585	RV smolt (high BKD)	0	0	3	0	0	0
		1995		No Release	0	0	0	0	0	1
		1994	24,002	RV smolt	0	0	3	0	0	1
				TOTAL			**18**			**3**
	2000	1997	66,144	LV presmolt	0	0	1	0	0	9
		1996	21,623	LV smolt (low BKD)	0	0	67	0	0	22
		1996	29,585	RV smolt (high BKD)	0	0	14	0	0	0
		1995		No Release	0	0	0	0	0	0
				TOTAL			**82**			**31**
	2001	1998	74,981	RV presmolt	0	0	0	0	0	1
		1997	66,114	LV presmolt	0	0	2	0	0	186
		1996	21,623	LV smolt (low BKD)	0	0	3	0	0	26
		1996	29,585	RV smolt (high BKD)	0	0	0	0	0	0
				TOTAL			**5**			**213**
Pahsimeroi River	1997	1992	46,473	LV smolt	0	0	0	31	11	42
		1993	147,429	RV smolt	30	31	61	16	16	32
		1994		No Release	0	0	0	2	0	2
				TOTAL			**61**			**76**

Appendix B Continued

Stream	Return Year	Juvenile Release Groups: Brood Year	Number Released	Mark and Life Stage	Number of Returning Adults: Supplementation Origin: Male	Female	Total	Natural Origin: Male	Female	Total
	1998	1993	147,429	RV smolt	18	15	33	29	26	55
		1994		No Release	0	0	0	8	12	20
		1995	122,017	AD smolt	19	0	19	0	0	0
				TOTAL			**52**			**75**
	1999	1994		No Release	0	0	0	12	2	14
		1995	122,017	AD smolt	92	115	207	28	39	67
		1996		No Release	0	0	0	11	0	11
				TOTAL			**207**			**92**
	2000	1995	122,017	AD smolt	8	24	32	11	8	19
		1996		No Release	0	0	0	35	26	61
		1997	135,699	AD smolt	73	0	73	15	0	15
				TOTAL			**105**			**95**
	2001	1996		No Release	0	0	0	54	33	87
		1997	135,699	AD smolt	192	323	515	68	84	152
		1998	53,837	AD smolt	28	0	28	7	0	7
				TOTAL			**543**			**246**
South Fork Salmon River	1997	1994	234,314	LV smolt	21	0	21	4	0	4
		1993	310,893	RV smolt	408	334	742	161	95	256
		1993	236,334	LV presmolt (NPT)	9	7	16	0	0	0
		1992	235,937	LV smolt	0	3	3	11	17	28
				TOTAL			**782**			**288**
	1998	1995	63,355	EL(orange) smolt	3	0	3	12	0	12
		1994	234,314	LV smolt	26	30	56	10	42	52
		1993	310,893	RV smolt	83	86	169	40	48	88
		1993	236,334	LV presmolt (NPT)	9	3	12	0	0	0
				TOTAL			**240**			**152**
	1999	1996	24,990	RV parr	0	0	0	51	0	51
		1996	22,982	EL(green) smolt	4	0	4	0	0	0
		1995	63,355	EL(orange) smolt	19	17	117	74	59	133
		1994	234,314	LV smolt	30	26	56	19	6	25
				TOTAL			**177**			**209**
	2000	1997	126,937	LV smolt	328	0	328	406	0	406
		1997	49,872	CWT presmolt	22	0	22	0	0	0
		1996	24,990	RV parr	2	8	10	158	105	263
		1996	22,982	EL(green) smolt	4	12	16	0	0	0
		1995	63,355	EL(orange) smolt	0	2	2	12	16	28
				TOTAL			**378**			**697**
	2001	1998	194,686	RV smolt	110	0	110	92	0	92
		1997	126,937	LV smolt	439	315	754	911	540	1451
		1997	49,872	CWT presmolt	120	78	198	0	0	0
		1996	24,990	RV parr	1	1	2	24	13	37
		1996	22,982	EL(green) smolt	0	0	0	0	0	0
				TOTAL			**1064**			**1580**
Upper Salmon River	1997	1992	72,300	LV smolt	1	1	2	39	30	69
		1993	27,778	AD/LV smolt	5	8	13	55	22	77
		1993	205,593	RV presmolt/smolt	8	3	11	0	0	0
		1994	24,319	AD smolt	1	0	1	9	0	9
				TOTAL			**27**			**155**
	1998	1993	27,778	AD/LV	0	2	2	45	48	93
		1993	205,593	RV presmolt/smolt	2	5	7	0	0	0
		1994	24,319	AD smolt	1	2	3	16	14	30
		1995	4,650	AD smolt	0	0	0	4	0	4
				TOTAL			**12**			**127**

Appendix B. Continued.

Stream	Return Year	Brood Year	Number Released	Mark and Life Stage	Supplementation Origin Male	Supplementation Origin Female	Supplementation Origin Total	Natural Origin Male	Natural Origin Female	Natural Origin Total
	1999	1994	24,319	AD smolt	1	2	3	24	12	36
		1995	4,650	AD smolt	5	7	12	52	14	66
		1996	43,161	AD smolt	59	0	59	20	0	20
				TOTAL			**74**			**123**
	2000	1995	4,650	AD smolt	18	19	37	41	32	73
		1996	43,161	AD smolt	31	103	134	267	98	365
		1997	105,951	CWT smolt	88	0	88	97	0	97
				TOTAL			**259**			**535**
	2001	1996	43,161	AD smolt	8	22	30	68	112	180
		1997	105,951	CWT smolt	243	187	430	275	170	445
		1998	123,425	CWT smolt	166	1	167	51	0	51
				TOTAL			**627**			**676**

[a] Mark: RV = right pelvic fin clip, LV = left pelvic fin clip, EL = elastomer injection, AD = adipose fin clip, CWT= coded-wire tag.

Appendix C. Summary of Chinook salmon redds counted in streams managed by the Idaho Department of Fish and Game for the Idaho Supplementation Studies in the Clearwater and Salmon River drainages, brood years 1997-2001. nc = no survey

Stream	Year	Stream Length	Number of Surveys	Number of Redds Counted	Redds per Kilometer
Clearwater Subbasin					
American River	2001	34.6	3	390	11.27
	2000	34.6	3	129	3.76
	1999	34.6	2	1	0.03
	1998	34.6	3	112	3.24
	1997	34.6	3	311	8.99
Big Flat Creek	2001	4.8	1	14	2.92
	2000	4.8	2	0	0.00
	1999	nc	0	—	—
	1998	nc	0	—	—
	1997	4.8	1	7	1.46
Brushy Fork Creek	2001	16.1	3	143	8.88
	2000	16.1	3	16	0.99
	1999	16.1	3	3	0.19
	1998	16.1	3	19	1.18
	1997	20.7	3	75	3.62
Colt Killed Creek	2001	50.2	1	113	2.25
	2000	50.2	1[a]	2	0.04
	1999	50.2	1[a]	0	0.00
	1998	50.2	1[a]	2	0.04
	1997	35.7	1	22	0.62
Crooked Fork Creek	2001	18	3	229	12.72
	2000	18	3	100	5.56
	1999	18	3	8	0.44
	1998	18	3	17	0.94
	1997	19	2	118	6.21
Crooked River	2001	20.9	3	136	6.51
	2000	20.9	3	93	4.45
	1999	20.9	2	1	0.05
	1998	20.9	3	30	1.44
	1997	20.9	3	62	2.97
Red River	2001	44.2	3	348	7.87
	2000	40.1	3	235	5.86
	1999	39.6	2	14	0.35
	1998	44.2	3	93	2.10
	1997	44.2	3	344	7.78
White Cap Creek	2001	19.8	1	18	0.91
	2000	19.8	1	8	0.40
	1999	12.9	1	0	0.00
	1998	19.8	1	4	0.20
	1997	19.8	1	0	0.00
Salmon Subbasin					
Lemhi River	2001	51.7	3[b]	339	6.56
	2000	51.7	3[b]	93	1.80
	1999	51.7	3[b]	48	0.93
	1998	51.7	3[b]	41	0.79
	1997	51.7	3[b]	50	0.97

Appendix C. Continued.

Stream	Year	Stream Length	Number of Surveys	Number of Redds Counted	Redds per Kilometer
Marsh Creek	2001	11	3	110	10.00
	2000	11	3	30	2.73
	1999	11	3	0	0.00
	1998	11	3	41	3.73
	1997	11	2	38	3.45
North Fork Salmon River	2001	36.8	2	102	2.77
	2000	15.2	1	11	0.72
	1999	36.8	1	2	0.05
	1998	36.8	1	3	0.08
	1997	36.8	1	10	0.27
Pahsimeroi River	2001	24.5	3	146	5.96
	2000	24.5	3	46	1.88
	1999	24.5	3	61	2.49
	1998	31.1	3	31	1.00
	1997	15.7	2	23	1.46
South Fork Salmon River	2001	24.5	4	493	20.12
	2000	24.5	3	315	12.86
	1999	22.6	2	281	12.43
	1998	20.2	1	149	7.38
	1997	20.2	3	264	13.07
Upper Salmon River	2001	59	1[a]	257	4.36
	2000	59	1[a]	146	2.47
	1999	59	1[a]	14	0.24
	1998	59	1[a]	25	0.42
	1997	59	1[a]	8	0.14

[a] Aerial survey only.
[b] Combination of aerial and ground surveys.

Appendix D. Number of Chinook salmon carcasses sampled during spawning ground surveys on Idaho Department of Fish and Game's Idaho Supplementations Studies streams for return years (RY) 1997 through 2001. Supplementation carcasses are grouped by mark type (AD = adipose fin clip, LV = left ventral fin clip, RV = right ventral fin clip, AD/CWT = adipose fin clip and coded-wire tagged, CWT = coded-wire tagged only).

					Supplementation				
Stream	**RY**	**Sex**	**Unknown**	**Natural**	**AD**	**LV**	**RV**	**AD/CWT**	**CWT**
American River	1997	Males	1	5	14	0	8	0	0
		Females	0	3	15	0	11	0	0
		Unk. Sex	0	0	0	0	0	0	0
		Total	**1**	**8**	**29**	**0**	**19**	**0**	**0**
	1998	Males	0	5	11	0	0	0	0
		Females	3	20	7	0	0	0	0
		Unk. Sex	0	0	0	0	0	0	0
		Total	**3**	**25**	**18**	**0**	**0**	**0**	**0**
	1999	Males	0	0	0	0	0	0	0
		Females	0	0	0	0	0	0	0
		Unk. Sex	0	0	0	0	0	0	0
		Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**
	2000	Males	2	19	48	0	0	0	0
		Females	1	11	47	0	0	0	0
		Unk. Sex	0	0	0	0	0	0	0
		Total	**3**	**30**	**95**	**0**	**0**	**0**	**0**
	2001	Males	0	31	54	0	0	2	3
		Females	1	33	64	0	1	1	2
		Unk. Sex	5	3	3	0	0	0	0
		Total	**6**	**67**	**121**	**0**	**1**	**3**	**5**
Brushy Fork Creek	1997	Males	0	8	16	0	0	0	0
		Females	0	14	17	0	1	0	0
		Unk. Sex	0	0	0	0	0	0	0
		Total	**0**	**22**	**33**	**0**	**1**	**0**	**0**
	1998	Males	0	1	1	0	0	0	0
		Females	0	6	0	0	0	0	0
		Unk. Sex	3	0	0	0	0	0	0
		Total	**3**	**7**	**1**	**0**	**0**	**0**	**0**
	1999	Males	0	0	0	0	0	0	0
		Females	0	1	2	0	0	0	0
		Unk. Sex	0	0	0	0	0	0	0
		Total	**0**	**1**	**2**	**0**	**0**	**0**	**0**
	2000	Males	0	0	0	0	0	0	0
		Females	0	1	2	0	0	0	0
		Unk. Sex	0	0	0	0	0	0	0
		Total	**0**	**1**	**2**	**0**	**0**	**0**	**0**
	2001	Males	2	24	2	0	0	0	0
		Females	0	19	3	0	0	0	0
		Unk. Sex	0	0	0	0	0	0	0
		Total	**2**	**43**	**5**	**0**	**0**	**0**	**0**
Crooked Fork Creek	1997	Males	0	3	31	1	3	0	0
		Females	0	2	46	0	2	0	0
		Unk. Sex	0	0	0	0	0	0	0
		Total	**0**	**5**	**77**	**1**	**5**	**0**	**0**
	1998	Males	1	2	1	0	0	0	0
		Females	0	11	4	0	1	0	0
		Unk. Sex	0	0	0	0	0	0	0
		Total	**1**	**13**	**5**	**0**	**1**	**0**	**0**

Appendix D. Continued.

Stream	RY	Sex	Unknown	Natural	Supplementation				
					AD	LV	RV	AD/CWT	CWT
	1999	Males	0	4	5	0	0	0	0
		Females	0	2	4	0	0	0	0
		Unk. Sex	1	0	0	0	0	0	0
		Total	**1**	**6**	**9**	**0**	**0**	**0**	**0**
	2000	Males	0	22	27	0	0	0	0
		Females	0	24	28	0	0	0	0
		Unk. Sex	0	0	0	0	0	0	0
		Total	**0**	**46**	**55**	**0**	**0**	**0**	**0**
	2001	Males	1	49	28	0	0	0	0
		Females	6	65	43	0	0	0	0
		Unk. Sex	0	0	0	0	0	0	0
		Total	**7**	**114**	**71**	**0**	**0**	**0**	**0**
Big Flat Creek	1997	Males	0	0	1	0	0	0	0
		Females	0	0	0	0	1	0	0
		Unk. Sex	0	0	0	0	0	0	0
		Total	**0**	**0**	**1**	**0**	**1**	**0**	**0**
	1998	Males	0	0	0	0	0	0	0
		Females	0	0	0	0	0	0	0
		Unk. Sex	0	0	0	0	0	0	0
		Total [a]	**0**	**0**	**0**	**0**	**0**	**0**	**0**
	1999	Males	0	0	0	0	0	0	0
		Females	0	0	0	0	0	0	0
		Unk. Sex	0	0	0	0	0	0	0
		Total [a]	**0**	**0**	**0**	**0**	**0**	**0**	**0**
	2000	Males	0	0	0	0	0	0	0
		Females	0	0	0	0	0	0	0
		Unk. Sex	0	0	0	0	0	0	0
		Total [a]	**0**	**0**	**0**	**0**	**0**	**0**	**0**
	2001	Males	0	0	1	0	0	0	0
		Females	0	1	2	0	0	0	0
		Unk. Sex	0	0	0	0	0	0	0
		Total	**0**	**1**	**3**	**0**	**0**	**0**	**0**
Colt Killed Creek	1997	Males	0	2	6	0	0	0	0
		Females	0	1	3	0	0	0	0
		Unk. Sex	0	0	0	0	0	0	0
		Total [b]	**0**	**3**	**9**	**0**	**0**	**0**	**0**
	1998	Males	0	0	0	0	0	0	0
		Females	0	0	0	0	0	0	0
		Unk. Sex	0	0	0	0	0	0	0
		Total [a]	**0**	**0**	**0**	**0**	**0**	**0**	**0**
	1999	Males	0	0	0	0	0	0	0
		Females	0	0	0	0	0	0	0
		Unk. Sex	0	0	0	0	0	0	0
		Total [a]	**0**	**0**	**0**	**0**	**0**	**0**	**0**
	2000	Males	0	0	1	0	0	0	0
		Females	0	0	1	0	0	0	0
		Unk. Sex	0	0	0	0	0	0	0
		Total	**0**	**0**	**2**	**0**	**0**	**0**	**0**
	2001	Males	0	1	10	1	0	0	0
		Females	0	10	11	1	0	0	0
		Unk. Sex	2	0	0	0	0	0	0
		Total	**2**	**11**	**21**	**2**	**0**	**0**	**0**
Crooked River	1997	Males	2	3	2	0	11	0	0
		Females	1	8	2	0	15	0	0
		Unk. Sex	0	0	0	0	0	0	0
		Total	**3**	**11**	**4**	**0**	**26**	**0**	**0**

Appendix D. Continued.

Stream	RY	Sex	Unknown	Natural	Supplementation				
					AD	LV	RV	AD/CWT	CWT
	1998	Males	1	0	0	5	2	0	0
		Females	1	0	0	6	1	0	0
		Unk. Sex	0	0	0	0	0	0	0
		Total	**2**	**0**	**0**	**11**	**3**	**0**	**0**
	1999	Males	1	1	2	0	0	0	0
		Females	0	1	0	0	0	0	0
		Unk. Sex	0	0	0	0	0	0	0
		Total	**1**	**2**	**2**	**0**	**0**	**0**	**0**
	2000	Males	0	10	40	1	0	0	0
		Females	0	4	24	0	0	0	0
		Unk. Sex	2	0	0	0	0	0	0
		Total	**2**	**14**	**64**	**1**	**0**	**0**	**0**
	2001	Males	5	32	31	0	0	0	0
		Females	3	18	24	0	0	0	2
		Unk. Sex	11	3	1	0	0	0	0
		Total	**19**	**53**	**56**	**0**	**0**	**0**	**2**
Red River	1997	Males	3	23	33	0	16	0	0
		Females	0	36	31	2	20	0	0
		Unk. Sex	0	0	0	0	0	0	0
		Total	**3**	**59**	**64**	**2**	**36**	**0**	**0**
	1998	Males	3	8	5	0	4	0	0
		Females	0	11	7	0	4	0	0
		Unk. Sex	0	0	0	0	0	0	0
		Total	**3**	**19**	**12**	**0**	**8**	**0**	**0**
	1999	Males	0	1	0	0	0	0	0
		Females	0	3	0	0	0	0	0
		Unk. Sex	0	0	0	0	0	0	0
		Total	**0**	**4**	**0**	**0**	**0**	**0**	**0**
	2000	Males	0	25	26	5	2	0	0
		Females	0	33	35	8	0	0	0
		Unk. Sex	0	0	0	0	0	0	0
		Total	**0**	**58**	**61**	**13**	**2**	**0**	**0**
	2001	Males	8	160	359	0	0	3	4
		Females	10	115	379	1	0	4	0
		Unk. Sex	92	23	59	0	0	0	0
		Total	**110**	**298**	**797**	**1**	**0**	**7**	**4**
Lemhi River	1997	Males	0	0	0	0	0	0	0
		Females	0	4	0	0	0	0	0
		Unk. Sex	0	0	0	0	0	0	0
		Total	**0**	**4**	**0**	**0**	**0**	**0**	**0**
	1998	Males	0	2	0	0	0	0	0
		Females	0	1	0	0	0	0	0
		Unk. Sex	0	0	0	0	0	0	0
		Total	**0**	**3**	**0**	**0**	**0**	**0**	**0**
	1999	Males	0	0	0	0	0	0	0
		Females	0	3	0	0	0	0	0
		Unk. Sex	0	0	0	0	0	0	0
		Total	**0**	**3**	**0**	**0**	**0**	**0**	**0**
	2000	Males	0	11	0	0	0	0	0
		Females	0	9	0	0	0	0	0
		Unk. Sex	0	0	0	0	0	0	0
		Total	**0**	**20**	**0**	**0**	**0**	**0**	**0**
	2001	Males	0	22	0	0	0	0	0
		Females	0	42	0	0	0	0	0
		Unk. Sex	0	0	0	0	0	0	0
		Total	**0**	**64**	**0**	**0**	**0**	**0**	**0**

Appendix D. Continued.

Stream	RY	Sex	Unknown	Natural	Supplementation AD	LV	RV	AD/CWT	CWT
Marsh Creek	1997	Males	0	3	0	0	0	0	0
		Females	0	5	0	0	0	0	0
		Unk. Sex	0	0	0	0	0	0	0
		Total	**0**	**8**	**0**	**0**	**0**	**0**	**0**
	1998	Males	0	11	0	0	0	0	0
		Females	1	23	0	0	0	0	0
		Unk. Sex	1	0	0	0	0	0	0
		Total	**2**	**34**	**0**	**0**	**0**	**0**	**0**
	1999	Males	0	0	0	0	0	0	0
		Females	0	0	0	0	0	0	0
		Unk. Sex	0	0	0	0	0	0	0
		Total [c]	**0**	**0**	**0**	**0**	**0**	**0**	**0**
	2000	Males	0	19	0	0	0	0	0
		Females	0	6	1	0	0	0	0
		Unk. Sex	0	1	0	0	0	0	0
		Total	**0**	**26**	**1**	**0**	**0**	**0**	**0**
	2001	Males	1	71	1	0	0	0	0
		Females	0	51	1	0	0	0	0
		Unk. Sex	7	0	0	0	0	0	0
		Total	**8**	**122**	**2**	**0**	**0**	**0**	**0**
North Fork Salmon River	1997	Males	0	0	0	0	0	0	0
		Females	0	0	0	0	0	0	0
		Unk. Sex	0	0	0	0	0	0	0
		Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**
	1998	Males	0	1	0	0	0	0	0
		Females	0	1	0	0	0	0	0
		Unk. Sex	0	0	0	0	0	0	0
		Total	**0**	**2**	**0**	**0**	**0**	**0**	**0**
	1999	Males	0	0	0	0	0	0	0
		Females	0	0	0	0	0	0	0
		Unk. Sex	0	0	0	0	0	0	0
		Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**
	2000	Males	0	1	0	0	0	0	0
		Females	0	4	0	0	0	0	0
		Unk. Sex	0	0	0	0	0	0	0
		Total	**0**	**5**	**0**	**0**	**0**	**0**	**0**
	2001	Males	0	12	0	0	0	0	0
		Females	0	16	0	0	0	0	0
		Unk. Sex	0	0	0	0	0	0	0
		Total	**0**	**28**	**0**	**0**	**0**	**0**	**0**
Pahsimeroi River	1997	Males	0	0	0	0	0	0	0
		Females	0	0	0	0	0	0	0
		Unk. Sex	0	0	0	0	0	0	0
		Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**
	1998	Males	0	0	0	0	0	0	0
		Females	0	1	0	0	0	0	0
		Unk. Sex	0	0	0	0	0	0	0
		Total	**0**	**1**	**0**	**0**	**0**	**0**	**0**
	1999	Males	1	2	3	0	0	0	0
		Females	1	5	3	0	0	0	0
		Unk. Sex	0	0	0	0	0	0	0
		Total	**2**	**7**	**6**	**0**	**0**	**0**	**0**
	2000	Males	0	1	2	0	0	0	0
		Females	0	1	2	0	0	0	0
		Unk. Sex	0	0	0	0	0	0	0
		Total	**0**	**2**	**4**	**0**	**0**	**0**	**0**

Appendix D. Continued.

Stream	RY	Sex	Unknown	Natural	Supplementation AD	LV	RV	AD/CWT	CWT
	2001	Males	0	5	6	0	0	0	0
		Females	0	10	7	0	0	0	0
		Unk. Sex	0	0	0	0	0	0	0
		Total	**0**	**15**	**13**	**0**	**0**	**0**	**0**
South Fork Salmon River	1997	Males	13	150	40	1	22	0	0
		Females	1	152	19	0	10	0	0
		Unk. Sex	4	0	1	0	0	0	0
		Total	**18**	**302**	**60**	**1**	**32**	**0**	**0**
	1998	Males	5	14	2	2	6	0	0
		Females	5	12	17	6	7	0	0
		Unk. Sex	1	0	0	0	0	0	0
		Total	**11**	**26**	**19**	**8**	**13**	**0**	**0**
	1999	Males	5	67	135	3	0	0	0
		Females	2	41	47	7	0	0	0
		Unk. Sex	1	0	1	0	0	0	0
		Total	**8**	**108**	**183**	**10**	**0**	**0**	**0**
	2000	Males	0	57	44	35	0	0	13
		Females	0	23	46	0	0	0	2
		Unk. Sex	0	0	0	0	0	0	0
		Total	**0**	**80**	**90**	**35**	**0**	**0**	**15**
	2001	Males	9	228	140	78	22	0	29
		Females	1	106	129	49	0	0	19
		Unk. Sex	0	0	0	0	0	0	0
		Total	**10**	**334**	**269**	**127**	**22**	**0**	**48**
Upper Salmon River and Alturas Lake Creek	1997	Males	0	0	0	0	0	0	0
		Females	0	0	0	0	0	0	0
		Unk. Sex	0	0	0	0	0	0	0
		Total[a]	**0**	**0**	**0**	**0**	**0**	**0**	**0**
	1998	Males	0	0	0	0	0	0	0
		Females	0	0	0	0	0	0	0
		Unk. Sex	0	0	0	0	0	0	0
		Total[a]	**0**	**0**	**0**	**0**	**0**	**0**	**0**
	1999	Males	1	17	8	0	0	0	0
		Females	0	5	0	0	0	0	0
		Unk. Sex	0	0	0	0	0	0	0
		Total	**1**	**22**	**8**	**0**	**0**	**0**	**0**
	2000	Males	0	39	0	0	0	0	0
		Females	1	16	1	0	0	0	0
		Unk. Sex	0	0	0	0	0	0	0
		Total	**1**	**55**	**1**	**0**	**0**	**0**	**0**
	2001	Males	1	26	0	0	0	0	60
		Females	0	11	4	0	0	0	8
		Unk. Sex	0	2	0	0	0	0	0
		Total	**1**	**39**	**4**	**0**	**0**	**0**	**68**

[a] This was an aerial redd count survey, no ground surveys conducted.
[b] Two Chinook carcasses were recovered in Colt Cr (a tributary of Colt Killed Creek) and included in this survey.
[c] No redds were observed during redd count surveys.

Appendix E. Trapping operations for juvenile Chinook salmon in streams managed by the Idaho Department of Fish and Game, 1997-2001.

		Trapping Period		
Stream	**Calendar Year**	**Start Date**	**End Date**	**Total Days Trapped**
Clearwater Subbasin				
American River	2001	03/28/01	11/6/01	214
	2000	3/23/00	10/31/00	175
	1999	3/26/99	11/1/99	212
	1998	07/01/98	10/26/98	49
Colt Killed Creek	2001	03/11/01	11/09/01	192
	2000	03/24/00	11/10/00	220
	1999	03/12/99	11/10/99	202
	1998	07/11/98	11/11/98	115
Crooked Fork Creek	2001	03/11/01	11/09/01	226
	2000	03/10/00	11/09/00	229
	1999	03/14/99	11/10/99	194
	1998	03/11/98	11/11/98	225
	1997	03/18/97	11/11/97	183
Crooked River	2001	03/23/01	11/06/01	219
	2000	03/23/00	10/31/00	180
	1999	03/19/99	11/01/99	201
	1998	03/12/98	10/26/98	219
	1997	04/06/97	11/04/97	91
Red River	2001	03/29/01	11/06/01	213
	2000	03/23/00	10/31/00	183
	1999	03/25/99	11/01/99	211
	1998	04/02/98	10/27/98	162
	1997	04/03/97	11/04/97	112
Salmon Subbasin				
Lemhi River	2001	03/14/01	12/17/01	269
	2000	03/07/00	12/05/00	263
	1999	03/16/99	12/06/99	235
	1998	03/18/98	12/04/98	170
	1997	03/17/97	12/07/97	243
Marsh Creek	2001	05/30/01	11/04/01	143
	2000	03/15/00	06/22/00	96
	1999	03/19/99	11/03/99	229
	1998	03/19/98	11/08/98	229
	1997	07/16/97	11/15/97	122
Pahsimeroi River	2001	02/26/01	11/27/01	243
	2000	03/03/00	12/05/00	273
	1999	03/17/99	11/30/99	249
	1998	03/13/98	11/30/98	219
	1997	03/06/97	12/02/97	272
SF Salmon River	2001	03/20/01	10/13/01	158
	2000	02/23/00	10/24/00	203
	1999	03/14/99	10/16/99	164
	1998	03/12/98	10/12/98	154
	1997	03/16/97	10/19/97	119
Upper Salmon River	2001	03/19/01	11/04/01	227
	2000	03/22/00	11/15/00	209
	1999	04/03/99	11/03/99	114
	1998	03/21/98	11/10/98	128
	1997	08/08/97	12/17/97	132

Appendix F. Brood year production estimates from emigrating juvenile Chinook salmon in streams managed by the Idaho Department of Fish and Game, 1996-2000 (NT = no trapping, NE = no estimate calculated).

Stream	Brood Year	Abundance Estimate	90% Confidence Interval
American River	1999	853	522-1504
	1998	72,898	65,068-81,214
	1997	493,596	445,652-553,077
	1996	NT	
	1995	NT	
Colt Killed Creek	1999	610	274-1,045
	1998	4,330	2,447-7,344
	1997	15,169	7,201- 24,177
	1996	NT	
	1995	NT	
Crooked Fork Creek	1999	7,161	5,535-9,697
	1998	15,549	12,588-18,597
	1997	37,511	34,397-40,364
	1996	7,998	6,926-9,437
	1995	2,327	1,765-2,979
Crooked River	1999	611	321-980
	1998	12,125	8,076-17,142
	1997	12,132	10,809-13,369
	1996	6,422	5,616-7,375
	1995	NE	
Red River	1999	2,077	1,778-2,441
	1998	50,148	46,510-53,405
	1997	55,617	50,178-61,964
	1996	33,848	27,895-43,855
	1995	547	341-867
Lemhi River	1999	13,098	11,604-14,797
	1998	12,557	11,060-14,180
	1997	45,355	41,716-49,171
	1996	6,791	5,677-8,269
	1995[a]	2,020	1,593-2,441
Marsh Creek	1999	NT	
	1998	32,332	27,831-37,324
	1997	21,936	19,583-24,186
	1996	3,840	3,473-4,321
	1995	NT	
Pahsimeroi River	1999	7,998	6,926-9,437
	1998	2,327	1,765-2,979
	1997	21,936	19,583-24,186
	1996	3,840	3,473-4,321
	1995	4,330	2,447-7,344

Appendix F. Continued.

Stream	Brood Year	Abundance Estimate	90% Confidence Interval
S.F. Salmon River	1999	88,881	80,583-97,332
	1998	169,790	157,624-181,897
	1997	158,651	146,459-173,656
	1996	18,690	17,136- 20,480
	1995	24,733	21,607-29,158
Upper Salmon River	1999	9,271	7,933-10,743
	1998	19,677	12,786-28,823
	1997	7,854	4,702-13,061
	1996	13,922	6,325-19,737
	1995	NT	

[a] Smolts were not estimated in spring 1997 due to low emigration numbers.

Appendix G. Detections of wild/natural juvenile Chinook salmon PIT tagged in most streams managed by the Idaho Department of Fish and Game that were naturally produced in brood years 1995-1999. Number detected is the total number of unique detections from one of the four lower Snake River hydropower detection sites (Lower Granite, Little Goose, Lower Monumental, and McNary).

Stream	Brood Year	Life Stage	Number Pit Tagged	Number Detected	First Detection Date	Number of Detections at Lower Granite Dam	10% Passage at Lower Granite Dam	50% Passage at Lower Granite Dam	90% Passage at Lower Granite Dam
American River	1997	presmolt	307	31	04/18/99	8	4/25	5/9	7/27
		smolt	532	217	04/26/99	97	5/25	6/15	7/9
	1998	presmolt	1147	119	04/08/00	47	4/13	5/2	7/28
		smolt	623	216	04/27/00	114	5/19	6/22	7/13
	1999	presmolt	45	6	04/29/01	5	4/28	5/27	7/3
		smolt	75	28	05/14/01	23	5/31	6/16	7/14
Colt Killed Creek	1997	presmolt	160	39	04/14/99	10	4/22	6/1	6/20
		smolt	177	82	04/23/99	38	5/18	6/13	7/4
	1998	presmolt	120	34	04/14/00	16	4/14	5/9	5/31
		smolt	164	50	04/24/00	24	4/28	5/18	6/25
	1999	presmolt	34	6	04/19/01	5	4/18	5/13	5/16
		smolt	48	34	04/16/01	28	5/9	5/28	6/10
Crooked Fork Creek	1995	presmolt	542	99	04/09/97	43	4/18	4/30	5/18
		smolt	35	13	05/13/97	6	5/12	6/5	6/23
	1996	presmolt	989	439	04/03/98	234	4/21	5/6	5/24
		smolt	298	148	04/24/98	72	5/3	5/25	7/6
	1997	presmolt	2609	694	04/08/99	172	4/21	5/13	6/17
		smolt	527	273	04/21/99	119	4/28	6/5	7/11
	1998	presmolt	1198	279	04/12/00	108	4/15	5/4	5/31
		smolt	195	74	04/17/00	33	4/25	5/25	6/29
	1999	presmolt	626	223	04/15/01	189	5/3	5/23	6/12
		smolt	236	118	04/30/01	102	5/11	6/3	6/15
Crooked River	1995	smolt	1	1	05/20/97	1	5/20	5/20	5/20
	1996	presmolt	85	21	04/05/98	17	4/4	4/28	5/18
		smolt	393	193	04/22/98	101	5/3	5/26	6/26
	1997	presmolt	281	49	04/12/99	14	4/19	5/1	6/6
		smolt	465	182	04/25/99	72	5/9	6/5	7/1
	1998	presmolt	244	30	04/13/00	15	4/13	5/1	6/1
		smolt	151	49	04/29/00	25	5/6	6/20	7/16
	1999	presmolt	9	1	06/15/01	1	6/14	6/14	6/14
		smolt	64	34	04/11/01	33	5/10	6/9	7/6
Red River	1995	presmolt	31	7	04/11/97	7	4/10	4/20	6/2
		smolt	63	26	04/30/97	10	5/17	5/27	6/21
	1996	presmolt	1394	401	05/17/96	218	4/4	4/26	6/4
		smolt	316	167	04/27/98	93	5/14	6/21	6/30
	1997	presmolt	1283	172	04/10/99	48	4/19	4/26	6/18
		smolt	358	137	04/30/99	61	5/25	6/14	7/12
	1998	presmolt	1247	214	04/11/00	80	4/13	4/19	5/15
		smolt	994	346	04/13/00	153	5/3	6/8	7/5
	1999	presmolt	366	83	04/11/01	72	4/20	5/4	6/2
		smolt	184	88	04/30/01	75	5/16	6/8	7/4
Marsh Creek	1996	presmolt	1007	514	04/04/98	314	4/22	5/4	5/14
		smolt	25	14	05/10/98	6	5/9	5/25	7/5
	1997	presmolt	2210	637	04/09/99	188	4/22	5/1	5/26
		smolt	155	94	04/30/99	31	5/25	6/20	7/13
	1998	presmolt	2188	464	04/07/00	229	4/20	5/2	5/25
		smolt	263	122	04/21/00	65	5/9	6/28	7/14
	1999	smolt	1	0	(blank)	0			
SF Salmon River	1995	presmolt	1362	163	04/03/97	73	4/16	4/23	5/17
		smolt	417	139	04/22/97	74	5/11	5/17	6/23
	1996	presmolt	1762	457	04/02/98	265	4/18	5/4	5/26
		smolt	410	168	05/03/98	85	5/13	5/27	7/4
	1997	presmolt	2858	400	04/11/99	121	4/20	4/27	5/31
		smolt	952	439	04/19/99	172	5/7	6/4	6/18
	1998	presmolt	4646	657	04/03/00	299	4/15	5/2	5/28
		smolt	1538	444	04/16/00	203	5/6	6/28	7/8

Appendix G. Continued.

Stream	Brood Year	Life Stage	Number Pit Tagged	Number Detected	First Detection Date	Number of Detections at Lower Granite Dam	10% Passage at Lower Granite Dam	50% Passage at Lower Granite Dam	90% Passage at Lower Granite Dam
	1999	presmolt	1518	280	04/18/01	242	4/29	5/11	5/30
		smolt	480	222	04/30/01	186	5/15	5/26	6/23
Upper Salmon River	1996	presmolt	116	38	04/08/98	26	4/14	4/29	5/9
		smolt	223	143	04/29/98	83	5/3	5/9	5/18
	1997	presmolt	352	96	04/16/99	37	4/21	4/28	5/10
		smolt	279	147	04/22/99	49	5/1	5/23	6/8
	1998	presmolt	1034	219	04/11/00	109	4/15	4/23	5/6
		smolt	525	219	04/17/00	113	4/24	5/8	5/26
	1999	presmolt	918	218	04/24/01	189	4/30	5/12	5/22
		smolt	386	232	05/03/01	202	5/13	5/22	5/28

Appendix H. Detections of juvenile Chinook salmon PIT tagged in the Pahsimeroi River and Lemhi River by the Idaho Department of Fish and Game that were naturally produced in brood years 1995-1999. Number detected is the total number of unique detections from one of the four lower Snake River hydropower detection sites (Lower Granite, Little Goose, Lower Monumental, and McNary).

Stream	Brood Year	Life Stage	Age	Migratory Year	Number Pit Tagged	Number Detected	First Detection Date	Number of Detections at Lower Granite Dam	10% Passage at Lower Granite Dam	50% Passage at Lower Granite Dam	90% Passage at Lower Granite Dam
Pahsimeroi	1995	Smolt	0	1996	391	190	4/28	121	6/12	7/3	7/17
	1995	Presmolt	1	1997	99	27	4/12	16	4/12	4/21	5/7
	1995	Smolt	1	1997	19	9	4/14	4	4/14	4/27	5/25
	1996	Smolt	0	1997	146	57	5/27	27	6/2	6/23	7/1
	1996	Presmolt	1	1998	47	11	4/7	10	4/7	4/27	4/30
	1996	Smolt	1	1998	43	16	4/5	6	4/5	4/27	5/9
	1997	Smolt	0	1998	1185	775	5/27	468	7/2	7/9	7/27
	1997	Presmolt	1	1999	892	293	4/3	92	4/16	4/26	5/7
	1997	Smolt	1	1999	480	319	4/13	105	4/21	4/26	5/7
	1998	Smolt	0	1999	754	427	5/28	207	6/15	6/26	7/23
	1998	Presmolt	1	2000	868	262	4/11	119	4/14	4/22	4/30
	1998	Smolt	1	2000	321	178	4/6	57	4/14	4/22	5/4
	1999	Smolt	0	2000	1118	417	5/20	248	6/8	7/2	7/17
	1999	Presmolt	1	2001	1550	396	4/17	342	4/29	5/5	5/12
	1999	Smolt	1	2001	118	63	4/23	58	4/27	5/1	5/9
Lemhi	1995	Smolt	0	1996	3	2	6/18	0	-	-	0
	1995	Presmolt	1	1997	270	90	4/8	48	4/12	4/21	5/1
	1995	Smolt	1	1997	4	2	5/19	1	-	-	-
	1996	Smolt	0	1997	0	0	-	-	-	-	-
	1996	Presmolt	1	1998	734	307	4/1	182	4/11	4/24	5/3
	1996	Smolt	1	1998	139	95	4/21	62	4/25	5/7	5/15
	1997	Smolt	0	1998	36	22	6/24	12	6/24	7/8	7/22
	1997	Presmolt	1	1999	3615	1236	4/3	423	4/19	4/25	5/2
	1997	Smolt	1	1999	642	406	4/8	131	4/22	5/1	5/24
	1998	Smolt	0	1999	0	0	-	-	-	-	-
	1998	Presmolt	1	2000	1849	556	4/7	259	4/13	4/16	4/29
	1998	Smolt	1	2000	285	135	4/9	66	4/14	5/3	5/8
	1999	Smolt	0	2000	189	39	6/16	29	6/23	7/2	7/16
	1999	Presmolt	1	2001	1956	526	4/16	453	4/29	5/5	5/15
	1999	Smolt	1	2001	141	79	4/11	67	4/29	5/9	5/26

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